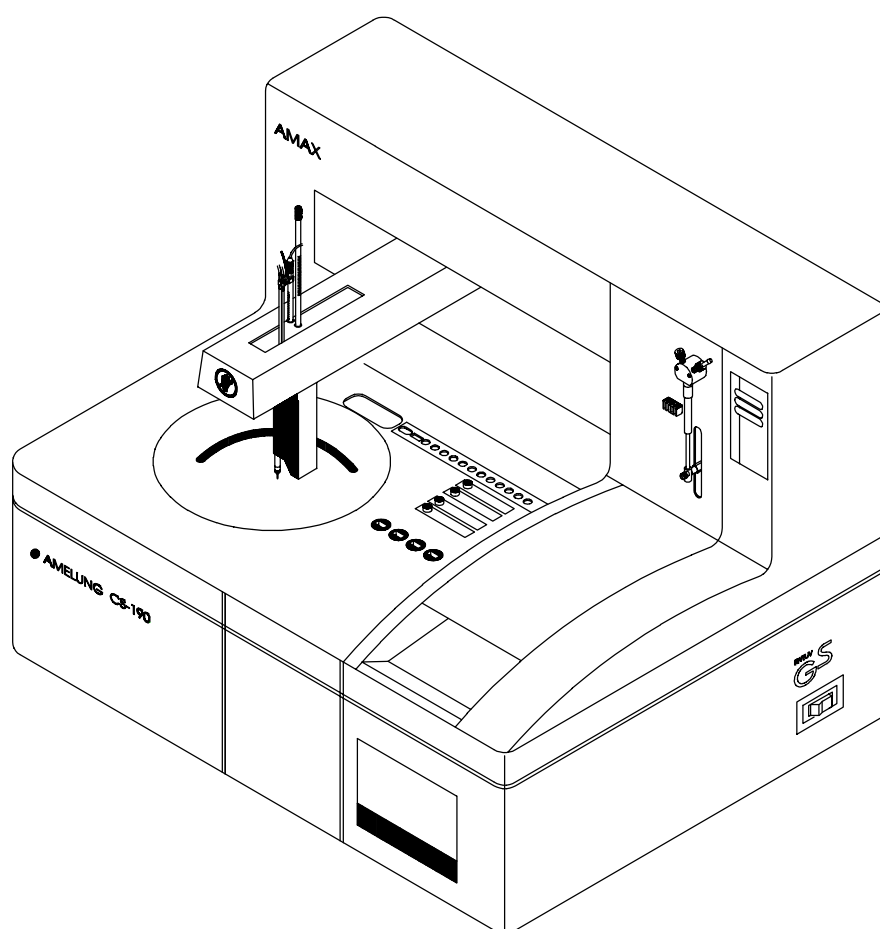


● A M E L U N G A M A X CS-190 Service Manual



Instrument manufactured by
Heinrich Amelung GmbH
Lemgo, Germany

Distributed by
Sigma Diagnostics
St. Louis, Missouri, USA

1.	Table of Contents	1 – 1
2.	Introduction	2 – 0
2.1	Brief Description of the Operational Characteristics of the AMAX CS-190	2 – 1
2.2	Traffic Lights	2 – 2
2.3	Pictograms	2 – 2
3.	Safety Regulation	3 – 0
3.1	Information on How to Avoid Danger to Life and Health	3 – 1
3.1.1	General Information	3 – 1
3.1.2	Information on the Repair of the AMAX CS-190	3 – 1
4.	Accessories / Equipment	4 – 0
4.1	Measurement and Adjustment Tools for Repairs	4 – 1
5.	Technical Data	5 – 0
5.1	Measurements	5 – 1
5.2	Weights	5 – 2
5.3	Electrical Connection Data	5 – 2
5.4	Temperatures	5 – 3
5.4.1	Temperatures of the Individual Modules	5 – 3
5.5	Intended Use	5 – 4
5.6	Throughput of the AMAX CS-190	5 – 5
6.	Measuring Methods	6 – 0
6.1	Mechanical Measuring Mode	6 – 1
6.2	Optical Measuring Mode (Clotting)	6 – 2
6.3	Optical Measuring Mode (Chromogenic)	6 – 4
7.	Instrument Installation	7 – 0
7.1	Instrument Overview	7 – 1
7.2	Installation of the AMAX CS-190	7 – 2
7.3	PC & Accessories	7 – 3
7.3.1	Jumper Settings of the AML-BUS-PC-Board	7 – 4
7.3.2	Jumper Settings of the Modem Boards	7 – 4
7.4	Printer Installation	7 – 5
7.5	Connections	7 – 7
7.5.1	Fresh Water / Waste Water System	7 – 7
7.5.2	Electrical Connections	7 – 8
7.6	Turning on the Instrument	7 – 9

8.	Subassemblies	8 – 0
8.1	Dilutor	8 – 1
8.1.1	Adjusting the Temperature of the Pre-heater	8 – 2
8.2	Mechanical Measuring Unit	8 – 3
8.2.1	Removing the Measuring Unit	8 – 4
8.2.2	Adjusting the Measuring Block Temperature	8 – 4
8.2.3	Adjusting the PC Temperature Display	8 – 5
8.2.4	Adjusting the Inductive Ball Sensors	8 – 5
8.2.5	Adjusting the Hinge Mechanism Voltage (knee joint)	8 – 6
8.2.6	Adjusting the Rotational Speed	8 – 7
8.2.7	Adjusting the Motor Torque Voltage of the Measuring Units	8 – 7
8.2.8	Adjusting the Dip-switches on the PH-M-MB (D05601) Board	8 – 8
8.3	Cuvette Magazine	8 – 9
8.3.1	Removing the Cuvette Magazine or the Incubation Rail	8 – 11
8.3.2	Adjusting the Mixer in the Incubation Rail (Q10005)	8 – 11
8.3.3	Adjusting the Ejector (Q10030)	8 – 12
8.3.4	Checking the Lifting Solenoid of the Incubation Rail	8 – 12
8.3.5	Adjusting the Temperature of the Incubation Rail	8 – 13
8.3.6	Adjusting the PC Temperature Display	8 – 13
8.3.7	Checking the Lifting Solenoids	8 – 14
8.3.8	Alignment Tools Magazine	8 – 15
8.3.9	Adjusting the Pusher 1 Unit	8 – 16
8.3.10	Alignment of the Cuvette Magazine in the AMAX CS-190	8 – 16
8.3.11	Adjusting the Light Barriers and the Cuvette Comb	8 – 18
8.3.12	Adjusting the Cuvette Comb	8 – 20
8.3.13	Checking the Reflex Light Barriers	8 – 22
8.3.14	Checking the Conveyors	8 – 23
8.4	Reagent-Plasma-Barcode	8 – 24
8.4.1	Adjusting the Cooling Circuits	8 – 25
8.4.2	Adjusting the PC Temperature Display	8 – 25
8.4.3	Adjusting the Cutoff Voltage of the Servo Power Amplifier	8 – 26
8.4.4	Adjusting the Mixer Voltage	8 – 26
8.4.5	Mechanical Reset Adjustments at the RPB	8 – 27
8.4.6	Adjusting the Barcode Scanner Position	8 – 27
8.5	Photometer	8 – 29
8.5.1	Removing the Measuring Unit	8 – 30
8.5.2	Adjusting the Temperature of each Measuring Channel	8 – 30
8.5.3	Adjusting the Photometer Lamp Voltage	8 – 31
8.5.4	Adjusting the Photometer Measuring Amplifier	8 – 31
8.6	XYZZ-Robot (gantry)	8 – 34
8.6.1	Adjusting the Safety Systems of the Control Unit	8 – 35

8.6.2	Voltage Cutoff of the X-Motor Amplifier	8 – 35
8.6.3	Voltage Cutoff of the Y-Amplifier	8 – 36
8.6.4	Speed Cutoff of the X-Motor Amplifier	8 – 37
8.6.5	Mechanical Reset Adjustment of the XYZZ-Robot	8 – 38
8.6.6	Adjusting the XY-Motors	8 – 39
8.6.7	Adjusting the Level Sensors (liquid level sensors and height sensors)	8 – 40
8.7	Water Temperatures	8 – 42
8.7.1	Adjusting the Water Reservoir II Temperature (D10068)	8 – 43
8.7.2	Adjusting the PC Temperature Display	8 – 43
9.	Maintenance	9 – 0
9.1	Refilling the System Fluids	9 – 1
9.2	Cleaning the Air Filter	9 – 2
9.3	Replacing the Photometer Lamp	9 – 3
9.3.1	Removing the Photometer Lamp	9 – 3
9.3.2	Inserting a New Lamp	9 – 4
9.4	Dilutor Syringe	9 – 5
9.4.1	Removing the Dilutor Syringe	9 – 5
9.4.2	Replacing the Teflon Seal	9 – 6
9.5	Cleaning the Photometer Channels	9 – 7
9.6	Pump Tubing, Waste Water Pump	9 – 8
9.7	Needle XYZZ-Robot	9 – 9
9.7.1	Replacing the Needle	9 – 9
9.7.2	Installing a New Needle	9 – 10
9.8	Cuvette Waste Drawer	9 – 11
10.	Spare Parts List	10 – 0
	Spare Parts List	10 – 1
11.	Service Software	11 – 0
	Description	11 – 1
11.1	Dilutor	11 – 6
11.2	Mechanical Measuring Unit	11 – 11
11.3	Cuvette Magazine	11 – 15
11.4	Reagent-Plasma-Tray	11 – 19
11.5	Photometer	11 – 23
11.6	XYZZ-Robot	11 – 33
11.7	Liquid Management	11 – 38
11.8	Text Viewer	11 – 41
11.9	Service Logbook	11 – 42
11.10	AMAX Teach in Program	11 – 43
11.10.1	Adjustable XY-Positions	11 – 47
11.10.2	Adjustable Z-Positions	11 – 49
11.11	Barcode Setup	11 – 51
11.12	AMAX Continuous Test Program	11 – 52

11.13	AMAX Continuous Test II	11 – 53
11.14	AMAX Self Test Program	11 – 54
11.15	Error Codes	11 – 55
11.16	AD Converter	11 – 55
11.17	Photometer Auto Align	11 – 56
11.18	Drip Test	11 – 57
12.	Troubleshooting	12 – 0
12.1	Error Examples	12 – 1
13.	Drawings	13 – 0
	Dilutor Block Diagram	13 – 1
	Dilutor Circuit Diagram	13 – 2
	Dilutor	13 – 3
	Mechanical Measuring Unit (Knee Joint) Block Diagram	13 – 4
	Mechanical Measuring Unit Block Diagram	13 – 5
	Measuring Block Heating Block Diagram	13 – 6
	Mechanical Measuring Unit Circuit Diagram	13 – 7
	Mechanical Measuring Unit	13 – 8
	Cuvette Magazine PC Board PH-K1 Block Diagram	13 – 9
	Cuvette Magazine PC Board PH-K5 Block Diagram	13 – 10
	Cuvette Magazine Circuit Diagram	13 – 11
	Cuvette Magazine	13 – 12
	Slide Pusher I	13 – 13
	Slide Pusher II	13 – 14
	Incubation Rail	13 – 15
	Reagent-Plasma-Tray Block Diagram	13 – 16
	Reagent-Plasma-Tray Circuit Diagram	13 – 17
	Reagent-Plasma-Tray	13 – 18
	Photometer Block Diagram	13 – 19
	Optical Measuring Unit Circuit Diagram	13 – 20
	Optical Measuring Unit	13 – 21
	Measuring Unit	13 – 22
	XYZZ-Cantilever Arm Block Diagram	13 – 23
	XYZZ Circuit Diagram	13 – 24
	Cantilever Arm	13 – 25
	Water Temperature Block Diagram	13 – 26
	Water Circulation System Circuit Diagram	13 – 27
	Water Temperature Control	13 – 28
	Water Tank	13 – 29

2. Introduction

2.1	Brief Description of the Operational Characteristics of the AMAX CS-190	2 – 1
2.2	Traffic Lights	2 – 2
2.3	Pictograms	2 – 2

Water Circulation System	13 – 30
Base Unit	13 – 31
Base Unit	13 – 32
Casing	13 – 33
Light Current Control	13 – 34
Photometer Amplifier	13 – 35
PC-AMAX Circuit Diagram	13 – 36
Wirering for AC/DC-Supply	13 – 37
Moduls PCB Location	13 – 38
14. LIS	14 – 0
14.1 Bidi-Protocol	14 – 1
14.1.1 Data Records	14 – 1
14.1.2 Header	14 – 1
14.1.3 Identification	14 – 1
14.1.4 Result /Test Order	14 – 1
14.1.5 ID-Query	14 – 2
14.1.6 Result	14 – 2
14.2 Communication Protocol	14 – 3
14.2.1 Master to Slave	14 – 3
14.2.2 Slave to Master	14 – 4
14.2.3 Command Characters and Symbols	14 – 5
14.2.4 Import	14 – 6
14.2.5 Result Transmission	14 – 8
14.2.6 Export	14 – 9
14.2.7 ID-Query	14 – 11
14.3 Host-Communication	14 – 13
14.3.1 Procedure of Processing Real-Time with Barcode	14 – 14
14.3.2 Master to Slave	14 – 15
14.3.3 Slave to Master	14 – 15
14.3.4 Result Transmission	14 – 16
14.3.5 Import of Requests (AMAX = MASTER)	14 – 17
14.3.6 Export of Results (AMAX = MASTER)	14 – 18
15. DOS Parameters	15 – 0
15.1 AMAX CS-190 DOS Parameters	15 – 1
15.2 Files in AMAX Directory	15 – 3

2.1 Brief Description of the Operational Characteristics of the AMAX CS-190

- The AMAX CS-190 is a fully automated coagulation instrument.
- The AMAX CS-190 is used for measuring the in-vitro coagulation times. Both plasma and whole blood samples can be used. 

5.5
- The instrument features an optical and a mechanical measuring unit. 

6.
- In addition to the clotting tests, chromogenic (kinetic) tests can be carried out by using the optical measuring unit. 

5.5
- The measured results can be converted to concentration or activity data with the help of storable standard curves.
- The PC identifies and stores patient samples and data.
- The samples are aspirated from their primary containers with a needle by way of the XYZZ-robot probe. Then the samples are mixed in a measuring cuvette with either a reagent and/or a buffer. After that the samples are incubated in the incubation rail (12 incubation slots). 

8.6
8.3
- At the end of the incubation period, the XYZZ-robot moves the cuvette into the optical or mechanical measuring unit. 

8.6
6.1
6.2
6.3
- After the addition of the starting reagent by the XYZZ-robot, the coagulation time is measured.
- Reagents, volumina and incubation periods can be programmed **individually**.
- Measured results and their calculations can be printed out in a protocol and stored simultaneously in the PC's patient archive.
- In addition, the results can be transferred to an external EDP (laboratory EDP) via bidirectional data transfer.

2.2 Traffic Lights

The traffic lights are positioned in the upper, right corner of the AMAX CS-190 next to the dilutor unit (user position in front of the instrument). The light signals have the following meanings:

Tab. 2.2.1

Light signal	Meaning
no light	AMAX CS-190 software booted, no errors registered, processing not yet started.
green light	AMAX CS-190 software booted, no errors registered, processing started
yellow light	WARNING: missing cuvettes, waste water reservoir full, fresh water reservoir empty, plasma-reagent-tray cover open, photometer lamp switched off
red light	ERROR: temperature outside operating range, photometer lamp not yet ready
green + red light	ERROR: XYZZ - waste water well full
running light	CANCEL: press any key - Instrument is aborting current process.

2.3 Pictograms

This service manual describes the maintenance and repair of the automatic coagulation instrument AMAX CS-190.

These instructions are written for qualified medical and technical personnel.

IMPORTANT!

Read these instructions carefully and work only in the prescribed manner!

Pay attention to warnings and notices!

Only in this way can damage to man and machine be avoided!



To increase the overall understanding of this manual, the following pictograms are used:

ATTENTION!

There is **DANGER TO LIFE** of the user!
Read these instructions carefully and work only in the prescribed manner!
Pay attention to warnings and notices!

Only in this way can damage to man and machine be avoided!



ATTENTION!

The AMAX CS-190 can be damaged!
Read these instructions carefully and work only in the prescribed manner!
Pay attention to warnings and notices!

Only in this way can damage to man and machine be avoided!



IMPORTANT / NOTICE!

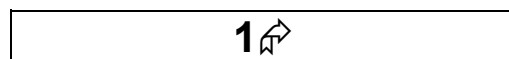
Requires additional operator action
or alteration of the adjustment parameters.



also see chapter



one turn to the 'right' (clockwise)



one turn to the 'left' (anti clockwise)



Amelung specific part number

(Q00000)

Key on the PC-keyboard

<X>

3. Safety Regulations

3.1	Information on How to Avoid Danger to Life and Health	3 – 1
3.1.1	General Information	3 – 1
3.1.2	Information on the Repair of the AMAX CS-190	3 – 1

It is guaranteed that the user is protected from **danger** to life and health when using the AMAX CS-190 in compliance with the regulations (§ 3(1) MedGV).

3.1 Information on How to Avoid Danger to Life and Health

3.1.1 General Information

- If the AMAX CS-190 shows any defects which might endanger patients or user personnel, it must not be operated (§ 6(1) MedGV).
- Wear protective clothing, especially protective gloves. It is a possibility that infected plasma (dangerous substances) might be touched.
- Protective clothing, especially protective gloves which were in contact with dangerous substances (e.g. infected plasma) have to be changed and disposed immediately (Technical rules for dangerous Substances (TRGS)).
- Plasma samples, reagents and waste water are toxic waste. The toxic waste has to be disposed in compliance with the operative regulations (laboratory regulations).

3.1.2 Information on the Repair of the AMAX CS-190

- While under repair the instrument must not be used for testing.
- After a repair, the AMAX CS-190 has to undergo a functionality check. This involves the carrying out of checking measurements. These actual values have to be equivalent to the theoretical values.

ATTENTION!

Live parts (power unit and connection panel) must not be touched!

DANGER TO LIFE!



ATTENTION!

On certain parts (photometer lamp or lamp casing) there is a

DANGER OF BURNS!



IMPORTANT!

Regular maintenance helps to avoid malfunctions and protects the AMAX CS-190 from damage.



4. Accessories / Equipment

4.1 Measurement and Adjustment Tools for Repairs 4 – 1

4.1 Measurement and Adjustment Tools for Repairs

It is recommended to always carry the following tools and adjustment gauges at every AMAX CS-190 service intervention:

Tab. 4.1.1

Measuring instruments / Tools	Catalog no.
Thermometer	121563
Surface probe	121565
Immersion probe	121564
Digital multimeter	
Oscilloscope incl. probes: 1:1 / 1:10	
Adjustment gauge I (magazine light barriers)	J01847
Adjustment gauge II (row pusher end light barrier)	J01827
Adjustment gauge III (adjustment gauge lifting solenoid)	J01819
Adjustment gauge (alignment pusher 1 unit)	J01820
Needle ejector tool	J01818
Spring balance	890300
Adjustment tool auto photometer height	J01817

5. Technical Data

5.1	Measurements	5 – 1
5.2	Weights	5 – 2
5.3	Electrical Connection Data	5 – 2
5.4	Temperatures	5 – 3
5.4.1	Temperatures of the Individual Modules	5 – 3
5.5	Intended Use	5 – 4
5.6	Throughput of the AMAX CS-190	5 – 5

5.1 Measurements

AMAX CS-190

• Height	ca.	56 cm (22.5 inches)
• Width	ca.	82 cm (32.75 inches)
• Depth	ca.	69 cm (27.75 inches)

Commander PC

• Height	ca.	12 cm (4.75 inches)
• Width	ca.	40 cm (16 inches)
• Depth	ca.	44 cm (17.75 inches)

Monitor (14 inches)

• Height	ca.	37 cm (15 inches)
• Width	ca.	35 cm (14 inches)
• Depth	ca.	39 cm (15.75 inches)

optional: Monitor (15 inches)

• Height	ca.	39 cm (15.75 inches)
• Width	ca.	39 cm (15.75 inches)
• Depth	ca.	36 cm (14.5 inches)

Keyboard

• Height	ca.	4 cm (1.5 inches)
• Width	ca.	46 cm (18.5 inches)
• Depth	ca.	17 cm (6.75 inches)

Printer

• Height	ca.	17 cm (6.75 inches)
• Width	ca.	36 cm (14.5 inches)
• Depth	ca.	21 cm (8.5 inches)

Base cabinet for the AMAX CS-190

• Height	ca.	71 cm (28.25 inches)
• Width	ca.	82 cm (32.75 inches)
• Depth	ca.	69 cm (27.75 inches)

5.2 Weights

• AMAX CS-190	ca.	130 kg (286 pounds)
• Base cabinet for AMAX CS-190	ca.	78 kg (172 pounds)
• Commander PC	ca.	10 kg (22 pounds)
• Monitor	ca.	11 kg (24.2 pounds)
• Printer	ca.	2,5 kg (5.5 pounds)

5.3 Electrical Connection Data

AMAX CS-190

• supply voltage		90-132 / VAC 180-265
• supply frequency		47-63 Hz
• power consumption	cold, max:	690 VA
	warm, min:	230 VA
• heat emission		1240 kJ/h

Commander PC

• supply voltage		90-132 / VAC 180-264
• supply frequency		50-60 Hz
• power consumption		145 VA

Monitor

• supply voltage		100-240 VAC
• supply frequency		47-63 Hz
• power consumption		80 VA

Printer

• supply voltage		230 VAC
• supply frequency		50 Hz
• power consumption		30 VA

5.4 Temperatures

The internal components of the Amelung Amax CS-190 are heated or cooled automatically. In order to guarantee the perfect performance of the AMAX CS-190, the following instructions have to be followed:

- The AMAX CS-190 must not be placed directly in front of a wall.
(**minimum distance 15 cm**)

- The ventilation grids must never be obstructed in any way.
(Cooling the AMAX CS-190 would be impossible)

- The system fluid supply has to be sufficient at all times.



9.1

- To provide a sufficient air flow, the air filter has to be clean.



9.2

- Do not expose the AMAX CS-190 to direct sunshine. The room temperature must **not exceed 32°C**.

ATTENTION!

Disregard may lead to malfunction of and cause damage to the AMAX CS-190!



5.4.1 Temperatures of the Individual Modules

- | | | |
|-------------------------------|-----|--------------|
| • reagent plasma barcode tray | ca. | 16.5 ± 1.5°C |
| • incubation rail | ca. | 37.5 ± 0.3°C |
| • optical measuring unit | ca. | 37.5 ± 0.3°C |
| • mechanical measuring unit | ca. | 37.5 ± 0.3°C |
| • cuvette magazine | ca. | 37.5 ± 0.3°C |
| • pre-heater | ca. | 40.0 ± 0.5°C |
| • cooling water system | ca. | 25 - 55°C |
| • warm water circuit (37°C) | | |
| washing in the well | ca. | 38.5 ± 0.5°C |
| pumping in the well | ca. | 38.5 ± 0.5°C |

The temperature in the well is measured by a liquid thermometer.

In the user software (main menu), select “Maintenance”, then “Wash”. The temperature is measured during the process “Wash” and “Fill”.

The warning limits for the temperatures can be entered in the user interface software.

In the case of a divergence, a message will be displayed on the monitor and the status lights will show yellow



2.2

show yellow.

In addition, an acoustic signal will sound and the AMAX CS-190 will not reactivate.

5.5 Intended Use

The AMAX CS-190 measures in-vitro coagulation times and chromogenic test reactions. Both citrated whole blood and citrated plasma samples can be used.

You can choose between the mechanical measuring and the optical measuring mode. Depending on the used reagents and measuring methods the following hemostasis parameters can be determined:

- **Prothrombin time (PT/Quick)**
- **Hepato-Quick**
- **Activated Partial Thromboplastin Time (APTT)**
- **Thrombin time (TT)**
- **Fibrinogen (Clauss)**
- **Fibrinogen (derived, optical density measurement)**
- **Normotest**
- **Thrombotest**
- **Factor assays: II, V, VII, VIII, IX, X, XI and XII**
- **AT III**
- **Plasminogen**
- **Antiplasmin**
- **PAI**
- **Heparin**
- **Protein S**
- **Protein C**
- **APC-Resistance**
- **and more**

5.6 Throughput of the AMAX CS-190

The throughput of the AMAX CS-190 is influenced by the type of measuring method used.

Tab. 5.6.1

	tests/hour	patients/hour	patients/hour
		single	double
PT-mechanical (pipetting mode 0)	180	180	90
PT- mechanical (pipetting mode 2)	240	240	120
PT-optical (pipetting mode 0)	190	190	95
PT-optical, derived fibrinogen	240	120	60
APTT-mechanical or optical	110	110	55
Fibrinogen (Clauss)	115	115	57
AT III	80	80	40
Factor assays	120	120	60
PT-mechanical/APTT	120	60	30
PT-mechanical/APTT/AT III	90	30	15

6. Measuring Methods

6.1	Mechanical Measuring Mode	6 – 1
6.2	Optical Measuring Mode (Clotting)	6 – 2
6.3	Optical Measuring Mode (Chromogenic)	6 – 4

The AMAX CS-190 features a mechanical and an optical measuring unit.

The mechanical measuring unit has 4 measuring cells which work with the ball method.

The optical measuring unit (photometer) has 4 measuring channels for measurement of the optical density. The wavelength of the light is 405nm.

The necessary total volumes for the measurements are:

- Mechanical measuring mode, minimum volume: 75µl
- Optical measuring mode, minimum volume: 150µl
- **Maximum volume** (mechanical, optical): 600µl

The individual measuring modes are described on the following pages.

6.1 Mechanical Measuring Mode

The time between the addition of the starting reagent and the beginning of the formation of fibrin is measured.

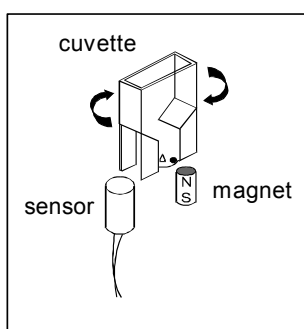
The sample and if necessary the reagent and/or buffer are pipetted into a measuring cuvette. After the incubation time it is placed into one of the mechanical measuring channels automatically.

There is a special steel ball on the bottom of the cuvette.

With the addition of the starting reagent, the cuvette starts to rotate around its longitudinal axes while the ball is held in a certain position by a magnet.

As coagulation begins, the ball is removed from its position by the forming fibrin threads, because the force of the magnet is overcome. A sensor detects the change of the ball's position and ends time measurement.

Pic. 6.1.1
schematic display of the
mechanical measuring mode

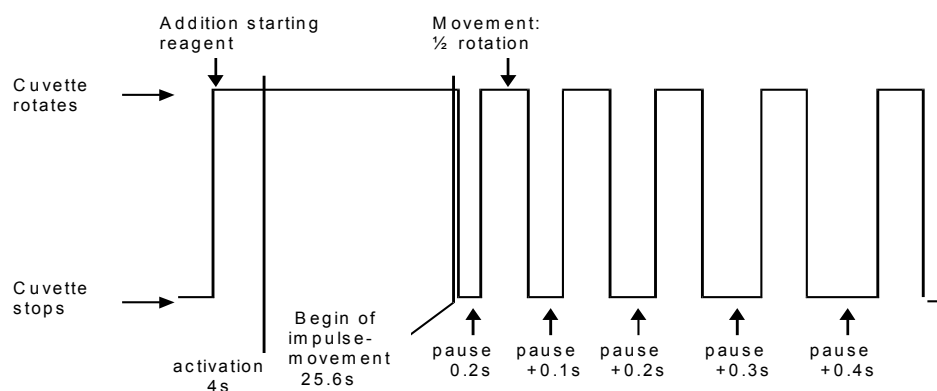


Impulse measurement

In order to detect very unstable clots with the mechanical method, the continuous rotation of the cuvette can be changed to a rotation with intervals after a predefined time.

In the example on Pic 6.1.2, the continuous movement is switched to interval movement after 25.6s. During the intervals, which prolong automatically, a clot cannot be detected, but it has time to stabilise itself. The CV rises in dependence with the length of the interval.

Pic. 6.1.2
Impulse measurement



6.2 Optical Measuring Mode (Clotting)

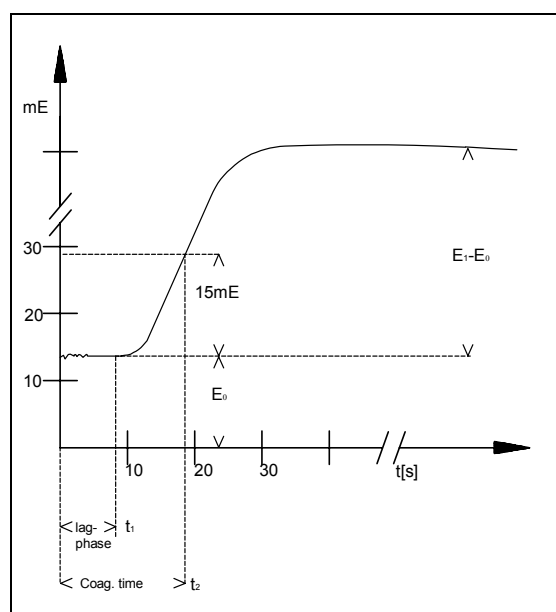
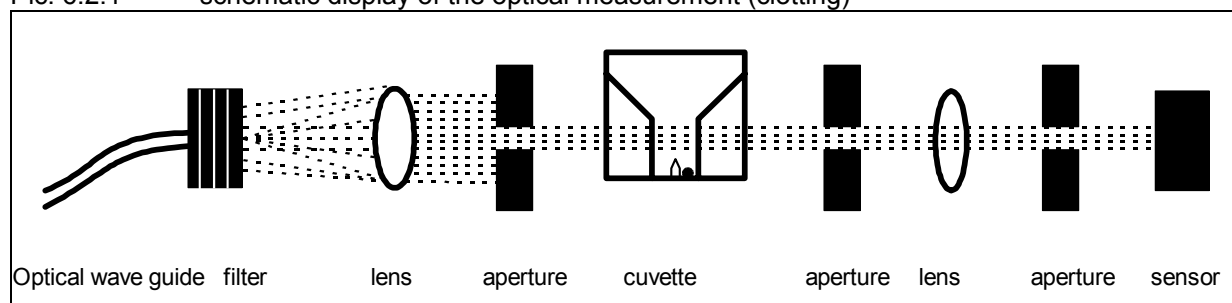
The time between the addition of the starting reagent and the beginning of the formation of fibrin is measured.

The sample and if necessary the reagent and/or buffer are pipetted into a measuring cuvette. After the incubation time it is placed into one of the optical measuring channels automatically.

The timing begins with the addition of the starting reagent. The intensity of the light beam that passes through the cuvette is monitored by a sensor. When clots are forming, the sample/reagent mixture becomes cloudy and the intensity of the light reaching the sensor decreases (turbidimetric measurement).

As soon as the change in the optical density reaches a pre-set threshold, the time measurement stops.

Pic. 6.2.1 schematic display of the optical measurement (clotting)



Pic. 6.2.2
Analysis of the optical measurement (clotting)

The coagulation time t_2 is the time taken from addition of the starting reagent to the point when the absorbance change has achieved the predefined threshold value. The absorbance change is measured from the stable baseline value at E_0 .
Example: 15mE (threshold value).

The derived fibrinogen is calculated from the difference between the maximum absorbance E_1 and the baseline value E_0 .

6.3 Optical Measuring Mode (Chromogenic)

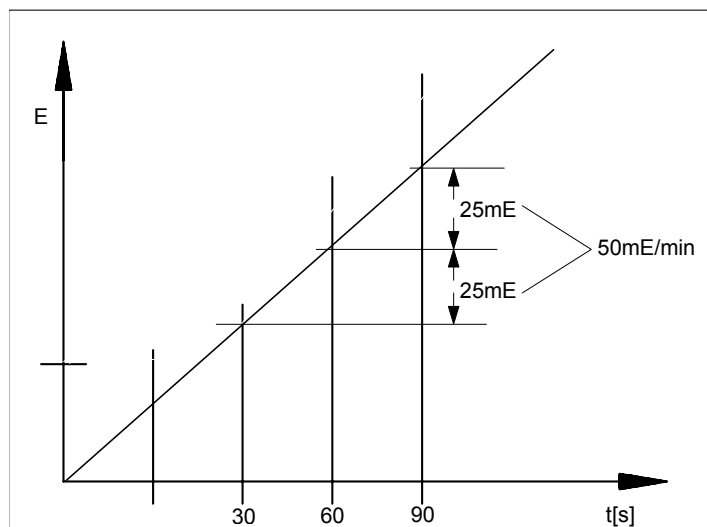
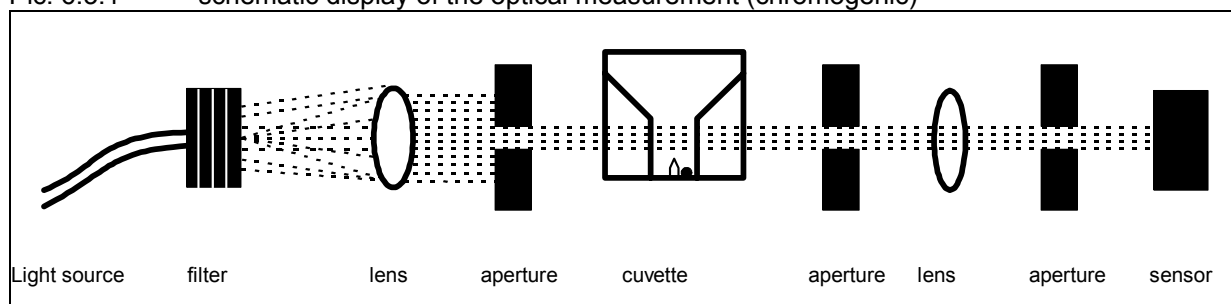
The rate of absorbance change is measured at predetermined intervals.

Sample and reagent are pipetted into a measuring cuvette and placed into one of the optical measuring channels. After the addition of the starting reagent, measurements are taken in defined intervals.

A monochrome light beam (405nm) passes through the cuvette. The change in optical density is measured by a sensor behind the cuvette at pre-defined intervals (kinetic measurement).

The values of change in mE/t are further mathematically processed.

Pic. 6.3.1 schematic display of the optical measurement (chromogenic)



Pic. 6.3.2 Analysis of the optical measurement (chromogenic)

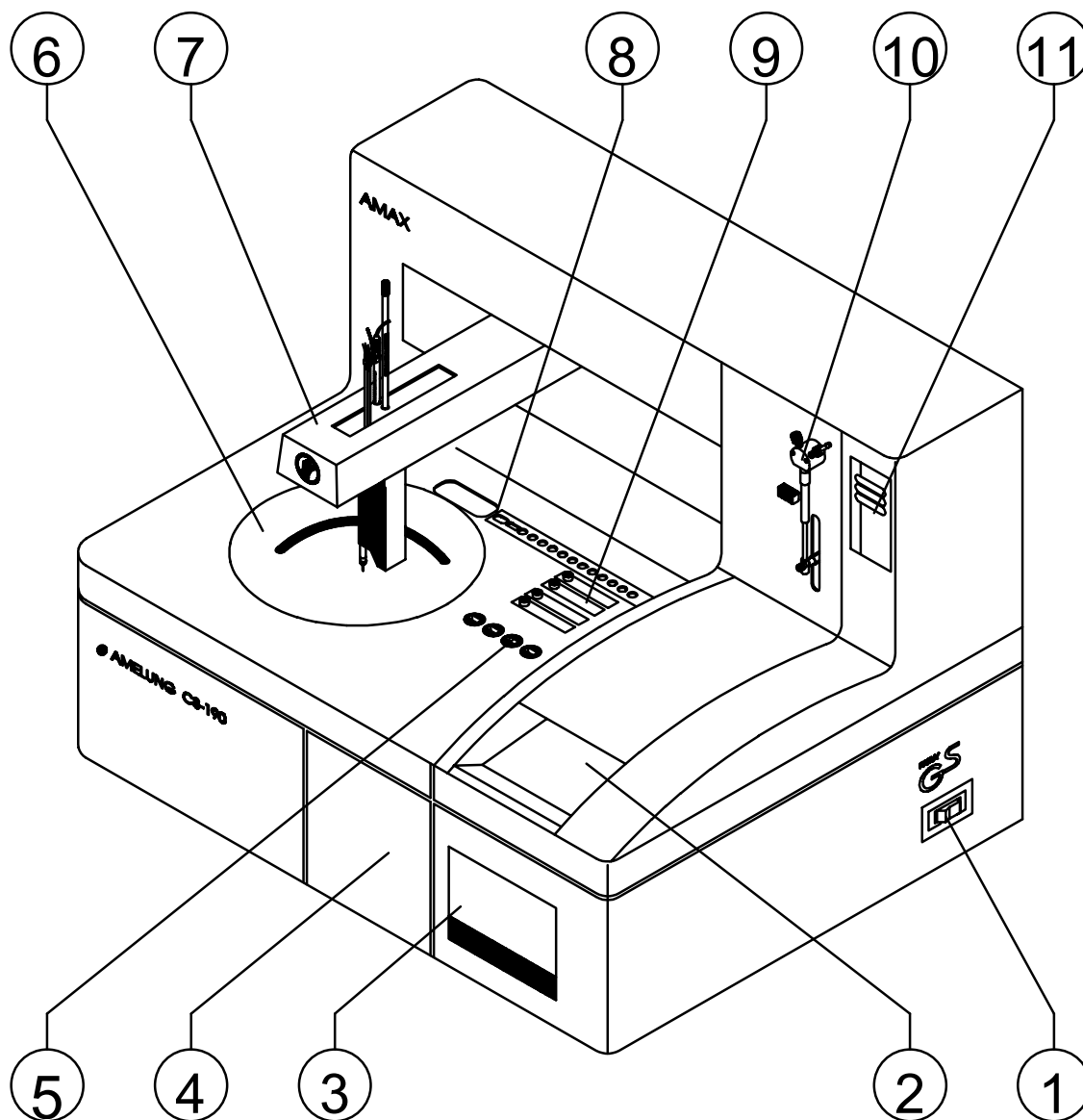
The absorbance increase within a defined interval (30/60/90) is measured and converted into E/min. The rate of absorbance change must be constant (linear).

7. Instrument Installation

7.1	Instrument Overview	7 – 1
7.2	Installation of the AMAX CS-190	7 – 2
7.3	PC & Accessories	7 – 3
7.3.1	Jumper Settings of the AML-BUS-PC-Board	7 – 4
7.3.2	Jumper Settings of the Modem Boards	7 – 4
7.4	Printer Installation	7 – 5
7.5	Connections	7 – 7
7.5.1	Fresh Water / Waste Water System	7 – 7
7.5.2	Electrical Connections	7 – 8
7.6	Turning on the Instrument	7 – 9

7.1 Instrument Overview

Pic. 7.1.1



Tab. 7.1.1

Overview	 [Chapter]
1. Mains switch	7.5
2. Cuvette magazine (front feed chute)	8.3 / 11.3
3. Cuvette magazine (front disposal chute)	8.3 / 11.3
4. Drawer (Disposal)	9.8
5. Mechanical measuring unit	8.2 / 11.2
6. Reagent-plasma-barcode	8.4 / 11.4
7. Robot (XYZZ)	8.6 / 11.6
8. Incubation rail	8.3 / 11.3
9. Photometer	8.5 / 11.5
10. Dilutor	8.1 / 11.1
11. Traffic lights	2.2

7.2 Installation of the AMAX CS-190

1. Remove the packaging material of the AMAX CS-190 and level the instrument on the base cabinet.

Fasten the connecting bolts which connect the base cabinet and the instrument.

2. **Do not turn on the instrument yet!**

All movable parts were secured for transport.

(XYZZ-robot: all axes were secured)

Remove all shipping clamps.

(check driving belt XY-axes, tapes, paper boards, etc.)

Check all movable parts for free movement.

3. Check the system coolant level,
if necessary fill up with original system liquid.
(830040 (500ml bottle)).



9.1

4. Configure PC & Accessories.



7.3

5. Connect the fresh/waste water reservoir and the liquid level sensors.



7.5

6. Establish all electrical connections between the PC and the AMAX CS-190.

7. Now the AMAX CS-190 can be turned on.



7.6

ATTENTION!

Remove all shipping clamps and securing devices before turning on the instrument.

Disregard may lead to malfunction of and cause damage to the AMAX CS-190!



Packaging material is recyclable!



7.3 PC & Accessories

1. Remove all packaging material of the PC, monitor, printer, etc.
In case the AML-Bus-Board (Board PH-PC (D02801)) or the modem board (Z04005) have not yet been installed, the PC has to be opened and the boards have to be placed into free slots.
Check and correct the jumper settings (see below) before the installation. Disregard may lead to malfunction or conflicts with other components.
2. Connect all components (**except** for the PC and the AMAX CS-190!) and establish all electrical connections.
3. Install the software:
First, switch on the PC, screen and printer. The PC installs its operating system automatically (selection: WINDOWS 3.1) After approx. 30 min. the installation is complete and you can continue by yourself. Deinstall WINDOWS with only the **DOS prompt** remaining on the hard drive.
Now the main software can be installed.
It consists of three or five 3,5" disks:
 - a. Disk with main menu AMAX CS-190
 - b. Disk for service software
 - c. Disk for AMAX CS-190 (instrument specific data)
 - d. Disk for modem software (option)
 - e. Disk for printer driver (printer specific)



7.4

7.3.1 Jumper Settings on the AML-BUS-PC-Board

There are two dip-switches on the **Board PH-PC** for adjusting the address.
The following switch adjustments have to be made so that the board can be identified:

Tab. 7.3.1

Dip-switch S1	Position	Dip-switch S2	Position
Switch 1	on	Switch 1	on
Switch 2	on	Switch 2	off
Switch 3	on	Switch 3	off
Switch 4	off	Switch 4	off

ATTENTION!

Disregard may lead to malfunction of the AMAX CS-190!



7.3.2 Jumper Settings of the Modem Boards

The different modems are not distinguishable by their names. For their differentiation, the BZT-No. is used here. This BZT-No. is printed on the packaging and on a label on the modem itself.

Tab. 7.3.2

Designation Internal fax-modem BZT-No. (Company)	Switch position for Com 3 IRQ 5
BZT - No. A109 822D	2,3,8
BZT - No. A107 434D (YAKUMO)	2 and 7 (7 is a soldering bridge)
BZT - No. A121 250F (CREATIX)	switch 1 and 6 to ON all others to Off
BZT - No. A106 901D	switch 1 and 6 to ON all others to Off
The initialisation string for these modems is: ATE0Q0V0L1X3%C1\N3\V1S0=2S7=100^M	

ATTENTION!

Disregard may lead to malfunction of the AMAX CS-190!



7.4 Printer Installation

There are different types of printer which can be used in combination with the AMAX CS-190.

Examples for installation:

1. Printer type Canon **BJC-240**

An installation disk (**BJ-setup program**) for **DOS** is delivered along with the printer. Installation is carried out according to the disk label or the printer's user manual (**directory: C:\bjprn**). The printer has to be turned on and connected to the PC. After the initiation of the printer software the settings of the printer control mode can be checked. The mode **must** be set to **LQ-Mode**. To complete the installation, the adjusted data has to be transferred to the printer with the function key **<F10>**.

ATTENTION!

Disregard may lead to malfunction of the AMAX CS-190!



2. Printer type Canon **BJ-200**

There is no installation disk for this printer. This printer is adjusted manually by using the dip switches:

Tab. 7.4.1

Dip-switch	Position
Switch no. 01	on
Switch no. 02	on
Switch no. 03	off
Switch no. 04	on
Switch no. 05	on
Switch no. 06	off
Switch no. 07	on
Switch no. 08	off
Switch no. 09	off
Switch no. 10	on
Switch no. 11	off
Switch no. 12	off

ATTENTION!

Disregard may lead to malfunction of the AMAX CS-190!



3. Printer type Canon **BJ-200 ex**

There is no installation disk for this printer. This printer is adjusted manually by using the dip switches:

Tab. 7.4.2

Dip-switch	Position
Switch no. 01	on
Switch no. 02	on
Switch no. 03	off
Switch no. 04	on
Switch no. 05	off
Switch no. 06	off
Switch no. 07	off
Switch no. 08	off
Switch no. 09	off
Switch no. 10	off
Switch no. 11	on
Switch no. 12	off

ATTENTION!

Disregard may lead to malfunction of the AMAX CS-190!



7.5 Connections

7.5.1 Fresh Water / Waste Water System

There is a connection panel for the fresh water / waste water system. Pic. 7.5.1.1 shows the connection panel.

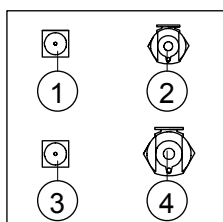
Connect the tubing (Q90006 / Q90007) with the panel and each fresh water / waste water reservoir (Q90004 / Q90005). In order to ensure perfect functioning, the tubing connectors have to lock into place precisely (audible). The tubing sets each have a cable with a BNC connector, which also have to be connected. The cables must not be interchanged because they are the control cables for the liquid level sensors in the reservoirs. Pic. 7.5.1.2 shows the position of the reservoirs. Pic. 7.5.1.3 shows the connections of a reservoir.

ATTENTION!

Disregard may lead to malfunction of the AMAX CS-190!

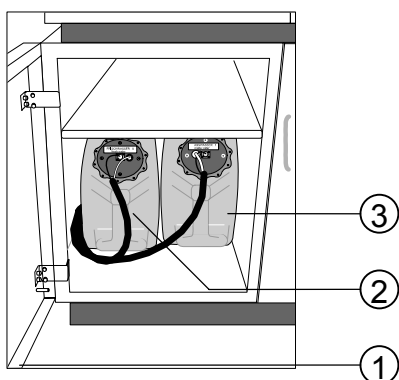


Pic. 7.5.1.1
Connection panel with level sensor connections



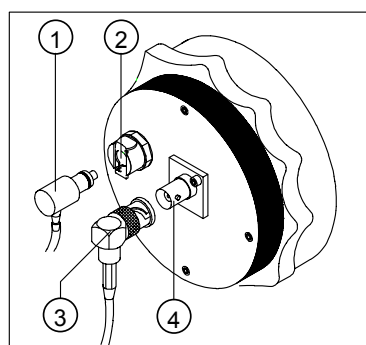
1. Plug contact - Fresh water level sensing
2. Fresh water connection
3. Plug contact - Waste water level sensing
4. Waste water connection

Pic. 7.5.1.2
Position of the reservoirs in the base cabinet



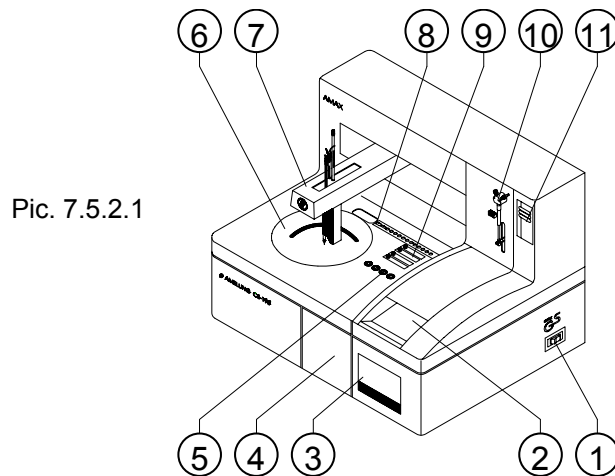
1. Base cabinet (left door)
2. Waste water reservoir
3. Fresh water reservoir

Pic. 7.5.1.3
Reservoir screw-lid with connections



1. Tubing
2. Connection socket for the tubing
3. Cable - Level sensor
4. Connection socket for the cable

7.5.2 Electrical Connections



Before working on the electrical connections:

IMPORTANT!

AMAX CS-190, PC, monitor and printer have to be turned off (switch position 0/AUS or OFF).



Pic 7.5.2.1 No. 1 shows the instrument main switch.

Technical data:

Switch:

Version (230V / 3.5A) (244210)

Version (110V / 6A) (244216)

ATTENTION!

The instrument fuse (reversible fuse) is positioned inside the mains switch. Replacing it after an activation is not necessary!



ATTENTION!

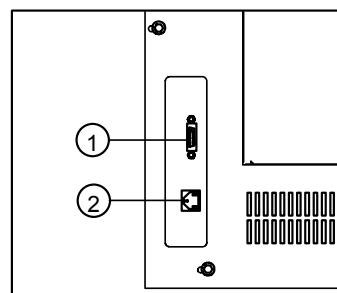
Disregard may lead to malfunction of the AMAX CS-190!



On the rear side of the AMAX CS-190 is a connection panel for the electrical connections (user position in front of the instrument).

Connect the 15-pin AML-Bus-cable (X10183) between the AMAX CS-190 and the PC. The cable has to be screwed into the panel and the PC correctly in order to function normally.

Pic. 7.5.2.2
Connection panel



1. AML-Bus connection
2. Power connection

Now connect the power cable to the AMAX CS-190 and a suitable power supply. (Fuse protection: 16A (safety cut-out: slow)). In addition, PC, monitor and printer have to be connected to the power supply.



5.3

ATTENTION!

Disregard may lead to malfunction of the AMAX CS-190!



7.6 Turning on the Instrument

If you have completed all steps successfully, you now may switch on all devices:

First turn on the AMAX CS-190, then all other components!

The AMAX CS-190 moves to its home position (all modules are initialised).

The instrument is ready when the traffic light shows **no** light and the screen shows the main menu.

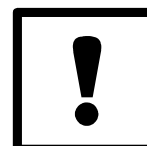


2.2

ATTENTION!

The instrument must not be turned on and off in short intervals (wait at least 10-15 seconds).

Disregard may lead to malfunction of the AMAX CS-190!



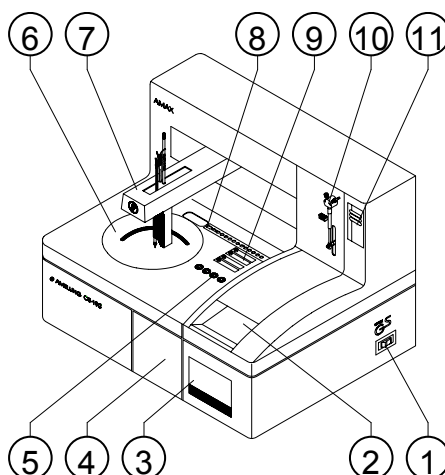
8. Subassemblies

8.1	Dilutor	8 – 1
8.1.1	Adjusting the Temperature of the Pre-heater	8 – 2
8.2	Mechanical Measuring Unit	8 – 3
8.2.1	Removing the Measuring Unit	8 – 4
8.2.2	Adjusting the Measuring Block Temperature	8 – 4
8.2.3	Adjusting the PC Temperature Display	8 – 5
8.2.4	Adjusting the Inductive Ball Sensors	8 – 5
8.2.5	Adjusting the Hinge Mechanism Voltage (knee joint)	8 – 6
8.2.6	Adjusting the Rotational Speed	8 – 7
8.2.7	Adjusting the Motor Torque Voltage of the Measuring Units	8 – 7
8.2.8	Adjusting the Dip-switches on the PH-M-MB (D05601) Board	8 – 8
8.3	Cuvette Magazine	8 – 9
8.3.1	Removing the Cuvette Magazine or the Incubation Rail	8 – 11
8.3.2	Adjusting the Mixer in the Incubation Rail (Q10005)	8 – 11
8.3.3	Adjusting the Ejector (Q10030)	8 – 12
8.3.4	Checking the Lifting Solenoid of the Incubation Rail	8 – 12
8.3.5	Adjusting the Temperature of the Incubation Rail	8 – 13
8.3.6	Adjusting the PC Temperature Display	8 – 13
8.3.7	Checking the Lifting Solenoids	8 – 14
8.3.8	Alignment Tools Magazine	8 – 15
8.3.9	Adjusting the Pusher 1 Unit	8 – 16
8.3.10	Alignment of the Cuvette Magazine in the AMAX CS-190	8 – 16
8.3.11	Adjusting the Light Barriers and the Cuvette Comb	8 – 18
8.3.12	Adjusting the Cuvette Comb	8 – 20
8.3.13	Checking the Reflex Light Barriers	8 – 22
8.3.14	Checking the Conveyors	8 – 23
8.4	Reagent-Plasma-Barcode	8 – 24
8.4.1	Adjusting the Cooling Circuits	8 – 25
8.4.2	Adjusting the PC Temperature Display	8 – 25
8.4.3	Adjusting the Cutoff Voltage of the Servo Power Amplifier	8 – 26
8.4.4	Adjusting the Mixer Voltage	8 – 26
8.4.5	Mechanical Reset Adjustments at the RPB	8 – 27
8.4.6	Adjusting the Barcode Scanner Position	8 – 27
8.5	Photometer	8 – 29
8.5.1	Removing the Measuring Unit	8 – 30
8.5.2	Adjusting the Temperature of each Measuring Channel	8 – 30
8.5.3	Adjusting the Photometer Lamp Voltage	8 – 31
8.5.4	Adjusting the Photometer Measuring Amplifier	8 – 31
8.6	XYZZ-Robot (gantry)	8 – 34
8.6.1	Adjusting the Safety Systems of the Control Unit	8 – 35

8.6.2	Voltage Cutoff of the X-Motor Amplifier	8 – 35
8.6.3	Voltage Cutoff of the Y-Amplifier	8 – 36
8.6.4	Speed Cutoff of the X-Motor Amplifier	8 – 37
8.6.5	Mechanical Reset Adjustment of the XYZZ-Robot	8 – 38
8.6.6	Adjusting the XY-Motors	8 – 39
8.6.7	Adjusting the Level Sensors (liquid level sensors and height sensors)	8 – 40
8.7	Water Temperatures	8 – 42
8.7.1	Adjusting the Water Reservoir II Temperature (D10068)	8 – 43
8.7.2	Adjusting the PC Temperature Display	8 – 43

8.1 Dilutor

Pic. 8.1.1
Dilutor unit (10)



Tab. 8.1.1 Structure dilutor unit (Q10007)

mechanical subassemblies		electronic subassemblies	
Dilutor component XL 3000W	(246005)	AM-DIL board	(D05701)
Pre-heater	(Q10020)	PH-MCK II board	(D03601)

There is a dip-switch on the PH-MCK II board for adjusting the module address. It also contains the program-IC (integrated chip) IC1, which can be replaced to update to a new program version.

The following switch adjustments have to be carried out so that the module can be identified.

Tab. 8.1.2

Dip-switch S1	position
Switch no. 1	on
Switch no. 2	off
Switch no. 3	off
Switch no. 4	off
Module address: 1	

ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.1.1 Adjusting the Temperature of the Pre-heater

In order to carry out the adjustments, the following instrument casings have to be removed:

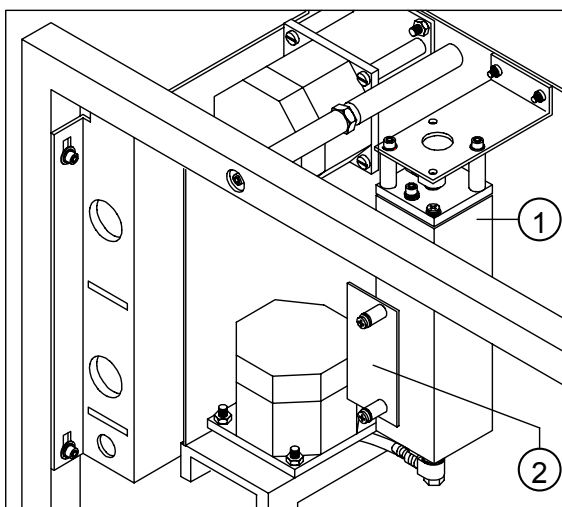
Rear casing (123268)

The pre-heater is positioned in the top left corner (dilutor unit) of the instrument (user position behind the instrument).

Pic. 8.1.1.1

Pre-heater (Q10020) (1)

Heating:
PH-I-HZ II board (D01101)(2)



The theoretical value of the heating is adjusted on the PH-I-HZ II (D01101) board (on which the pre-heater is mounted) by using the potentiometer **R16**.

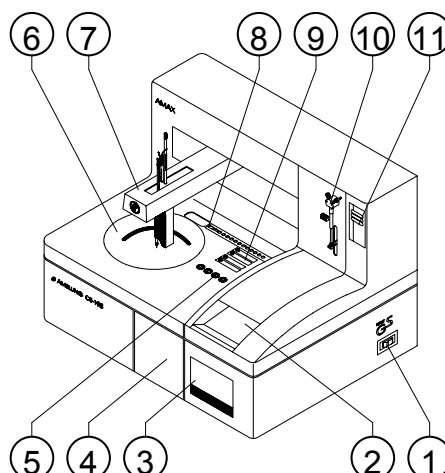
$1\text{ } \rightarrow = \text{approx. } - 1.0^{\circ}\text{C} / 1\text{ } \leftarrow = \text{approx. } + 1.0^{\circ}\text{C}$

As long as the LED V1 is lit, the heating is active and the temperature rises. The temperature of the reservoir should be $40^{\circ}\text{C} \pm 0.5^{\circ}\text{C}$.

The temperature is measured using a contact thermometer directly at the brass container through a hole in the pre-heater insulation.

8.2 Mechanical Measuring Unit

Pic. 8.2.1
Mechanical measuring unit (5)



Tab. 8.2.1 Structure mechanical measuring unit (Q10011)

mechanical subassemblies		electronic subassemblies	
knee joint	(D10074)	AM-M-SH board	(D06901)
		AM-M-HT board	(D06301)
		PH-TF board	(D06801)
		AM-S-HY board	(D06201)
		PH-HALL board	(D05201)

The PH-MCK (D00801) board is not in the module. It is integrated in the subassembly reagent/measuring unit drive (Q10080).

There is a dip-switch for adjusting the module address on the PH-MCK board. It also contains the program-IC (integrated chip) IC1, which can be replaced to update to a new program version.

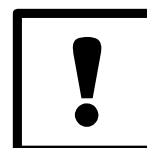
The following dip switch adjustments have to be carried out so that the module can be identified.

Tab. 8.2.2

Dip-switch S1	position
switch no. 1	off
switch no. 2	off
switch no. 3	on
switch no. 4	off
Module address: 2	

ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.2.1 Removing the Measuring Unit

In order to remove the measuring unit, the following instrument casings should be removed:

Upper structure	(123290)
Side casing left	(123289)
Working area	(123292)
Front plate left	(123293)
Side casing right	(123291)
Front plate right	(123294)
Magazine cover	(122432)

8.2.2 Adjusting the Measuring Block Temperature

The adjustments have to be carried out on the AM-M-SH (D06901) board. Place cuvettes, filled with approx. 200 µl water in the measuring channels.

In order to adjust the temperature of the measuring unit, the following instrument casings should be removed:

Upper structure	(123290)
Side casing left	(123289)
Working area	(123292)

The supply voltage should be turned on. The theoretical value of the heating is adjusted with potentiometer **R27**.

$$1\text{ } \uparrow = \text{approx. } + 1.0^{\circ}\text{C} / 1\text{ } \downarrow = \text{approx. } - 1.0^{\circ}\text{C}$$

As long as the light-emitting diode LED V4 is lit, the heating is active and the temperature rises. The current temperature can be measured in the cuvettes using the liquid thermometer.

The temperature should be at $37.5^{\circ}\text{C} \pm 0.3^{\circ}\text{C}$ when LED V4 goes out (after approx. 15 minutes).



5.4

The adjustment process is complete when the temperature of each cuvette is constant. After successful adjustment, the measuring block has a temperature of approx. 38.5°C . The temperature if measured on the sides of the aluminium block.

The adjustment can be carried out outside the instrument as well. The ambient air around the instrument should not be too cold (avoid draughts).

The adjustment should be checked again after the measuring unit has been reinstalled.

ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.2.3 Adjusting the PC Temperature Display

This adjustment is carried out on the PH-TF (D06801) board.

The current temperature of the measuring block can be queried using the **service program**.



11.2

The displayed value can be altered (adjusted) with potentiometer **R7**.

$$1 \uparrow = \text{approx. } - 0.5^{\circ}\text{C} / 1 \downarrow = \text{approx. } + 0.5^{\circ}\text{C}$$

The temperature should be measured on the sides of the aluminium-block using the contact thermometer. This value should then be adjusted to approx. 38.5 °C.

IMPORTANT!

The temperature displayed by the PC in the service program should always be equivalent to the current temperature.



ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.2.4 Adjusting the Inductive Ball Sensors

The adjustment is carried out at the ball sensors (D10079).

The mechanical measuring unit should be operational before the adjustment. The supply voltage should be turned on and the temperature should be adjusted correctly. Otherwise, the temperature adjustment has to be repeated (see: Adjusting the measuring block temperature).

An empty cuvette with a ball should be placed into every measuring channel. It is important that all measuring channels are closed.

The voltage to be adjusted can be measured on the AM-S-HY board (D06201) at MP2 using a multimeter. First, a voltage of approx. 2.9-3.1 Volt is adjusted. The adjustment is altered using the potentiometer in the ball sensor.

$$\uparrow = - / \downarrow = +$$

After an operation time of about 10 minutes, a voltage of 3.8 volts should be adjusted. Now, in order to check its functionality, the measuring unit can be started in the **service program**.



11.2

After the measuring channels have been started, they are stopped by blocking the ball using a non-metallic object. The LED V4 flashes once. It signals the stop-impulse. When the measuring unit stops, the sensor system is ready for operation. The electrical

adjustment and functionality check should be rechecked after another 15 minutes. If necessary, 3.8 volts should be readjusted.

Finally, the ball is glued solid in the cuvette and the measuring channel is started. An oscilloscope is now connected to MP2. The X18 plug has to be disconnected from the AM-M-SH board or the X1 plug from the PH-M-MB board in order to interrupt the monitoring of the AM-S-HY board. Otherwise, the measuring channels would stop again.

An amplitude of at least 1.5 volts should be visible.

After the measurement, the X18 or X1 plugs have to be plugged back into the AM-M-SH board or the AM-M-MB board.

ATTENTION!

Disregard can lead to malfunction of the A M A X C S - 1 9 0!



8.2.5 Adjusting the Hinge Mechanism Voltage (knee joint)

The supply voltage for the hinge mechanism stepper motors is adjusted using the potentiometer on the AM-M-SH (D06901) board.

$1\text{↗} = \text{approx. } + 1.0 \text{ V} / 1\text{↘} = \text{approx. } - 1.0 \text{ V}$

For that purpose, a digital voltmeter is connected to the LED V2 anode. The voltage should be $15 \text{ Volt} \pm 0.5$ to guarantee a safe opening and closing of the hinge.

ATTENTION!

Disregard can lead to malfunction of the A M A X C S - 1 9 0!



8.2.6 Adjusting the Rotational Speed

In order to carry out the adjustment, the following instrument casings should be removed:

Side casing left	(123289)
Front plate left	(123293)

The measuring unit should be operational.
One oscilloscope probe is connected to PIN 1 of plug X1 on the PH-M-MB (D05601) board.
The measuring unit channel no. 4 is started with the **service program**.



11.2

Using the potentiometer **R21**, the speed is adjusted so that the interval length of the signal is 375ms.

$1 \text{ } \rightarrow = \text{approx. } - 30\text{ms} / 1 \text{ } \leftarrow = \text{approx. } + 30\text{ms}$

This equals to 80 rpm (2 impulses per rotation of the measuring unit).

ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.2.7 Adjusting the Motor Torque Voltage of the Measuring Units

The stepper motor supply voltage used for turning the measuring units is adjusted using the potentiometer **R22** on the PH-M-MB (D05601) board.

$1 \text{ } \rightarrow = \text{approx. } + 300\text{mV} / 1 \text{ } \leftarrow = \text{approx. } - 300\text{mV}$

For this purpose, a digital multimeter is connected to the coil L1. The voltage must be approx. 6 volts ± 0.3 so that the measuring units can start smoothly and safely.

ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.2.8 Adjusting the Dip-switches on the PH-M-MB (D05601) Board

In order to carry out this adjustment, the following instrument casings should be removed:

Side casing left (123289)
Front plate left (123293)

There are two dip-switches on the PH-M-MB board: dip-switch S1 affects the stepper motors (complete- or half-step, direction of rotation); dip switch S2 affects the number of measuring units.

The following dip switch adjustments have to be carried out so that the mechanical measuring unit can function correctly.

Tab. 8.2.8.1

Dip-switch S1	position	Dip-switch S2	position
switch no. 1	on	switch no. 1	off
switch no. 2	on	switch no. 2	on
switch no. 3	on	switch no. 3	on
switch no. 4	off	switch no. 4	off

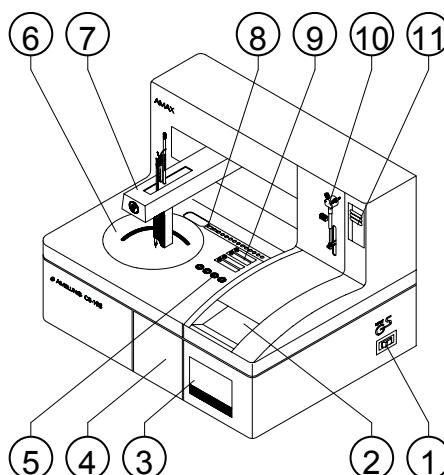
ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.3 Cuvette Magazine

Pic. 8.3.1
Cuvette magazine (2 & 3)



Tab. 8.3.1 Structure cuvette magazine (D10007)

mechanical subassemblies		electronic subassemblies	
Pusher I	(D10032)	PH-K5 board	(D03401)
Pusher II	(D10033)	PH-MCK board	(D08001)
Side part I	(D10060)		
Side part II	(D10061)		
Conveyor I	(D10062)		
Conveyor II	(D10063)		
Lifting solenoid stops	(D10038)		
Incubation rail	(Q10005)		

There is a dip-switch for adjusting the module address on the PH-MCK board. It also contains the program-IC (integrated chip) IC1, which can be replaced to update to a new program version.

The following dip switch adjustments have to be carried out so that the module can be identified.

Tab. 8.3.2

Dip-switch S1	position
switch no. 1	off
switch no. 2	off
switch no. 3	on
switch no. 4	on
Module address: 3	

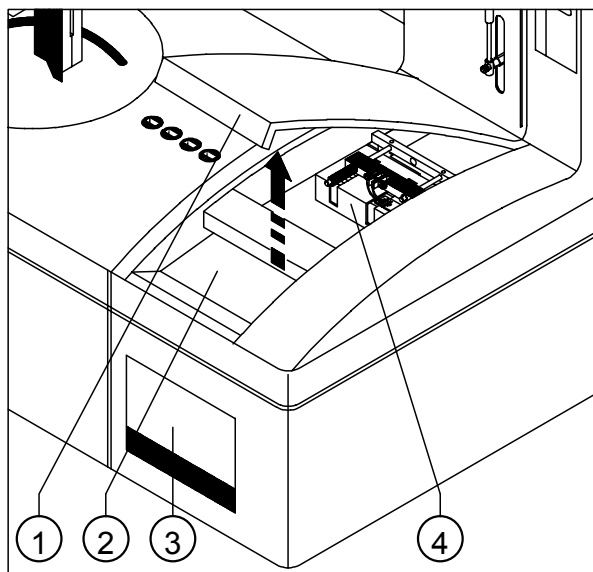
ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



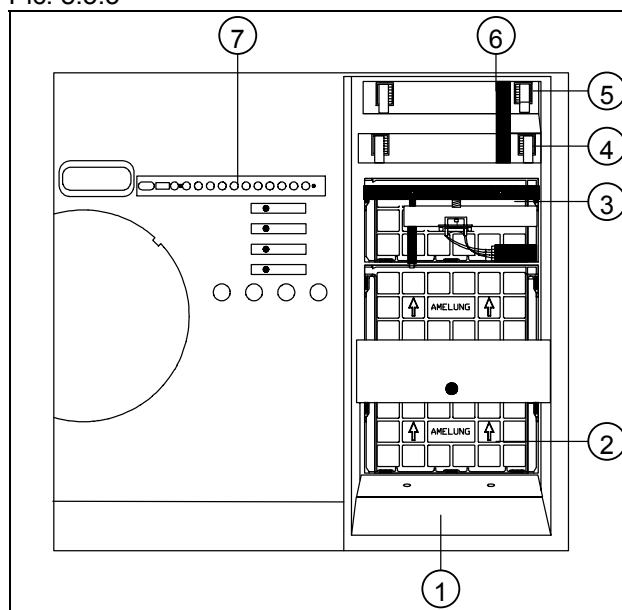
Pic. 8.3.2

- Cuvette magazine cover (1)
- Cuvette box loading area (2)
- Cuvette box disposal chute (3)
- Cuvette box (4)



Pic. 8.3.3

- Cuvette box loading area (1)
- Cuvette box (2)
- Cuvette comb (3)
- Feed conveyor (4)
- Disposal conveyor (5)
- Row pusher (6)
- Incubation rail (7)



8.3.1 Removing the Cuvette Magazine or the Incubation Rail

In order to remove the cuvette magazine or the incubation rail, the following instrument claddings should be removed:

Upper structure	(123290)
Side cladding left	(123289)
Work area	(123292)
Front plate left	(123293)
Side cladding right	(123291)
Front plate right	(123294)
Magazine cover	(122432)

After that each module can be removed. The corresponding cable connections have to be detached: supply voltage, module connections, light barrier cable, BUS-connections.

8.3.2 Adjusting the Mixer in the Incubation Rail (Q10005)

In order to carry out the adjustment, the following instrument claddings should be removed:

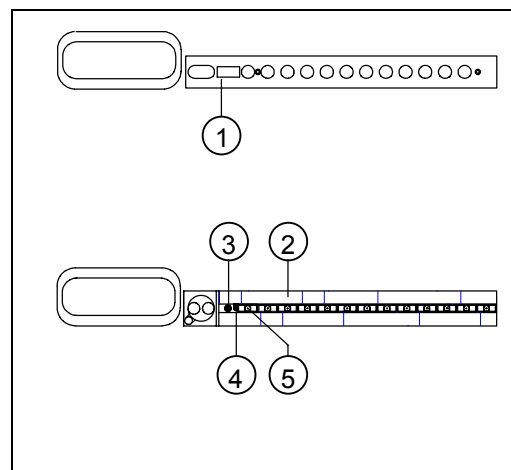
Upper structure	(123290)
Side cladding left	(123289)
Work area	(123292)

Pic. 8.3.2.1

The incubation rail (2) with the integrated mixer unit (D10071) is positioned under the incubation rail cover. The mixer-position (4) is in front of the ejector-position (3) and the lifting solenoid-position (4). (Blocking position1).

The mixer can be started with the **service program**.

The ball turns when a cuvette is positioned on the mixer position.



A stroboscopic effect can be observed when a line-powered (electric discharge lamp/ fluorescent lamp) lamp is held above the cuvette (assuming the rotational speed has been adjusted correctly). When the rotational speed is correct, “**3-4 stationary balls**” can be observed.

The rotational speed is adjusted with the potentiometer **R43** on the PH-K1 (D03001) board.

↺ = - / ↻ = +

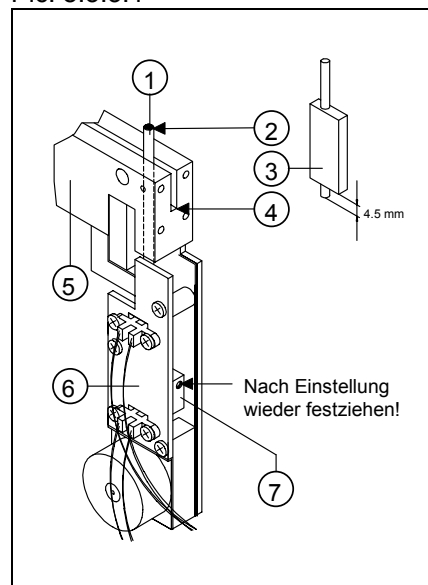
8.3.3 Adjusting the Ejector (Q10030)

The cuvette ejector (6) plunger (1) is adjusted with the alignment gauge (J0XXX). The ejector unit (6) has to be connected to the incubation rail (5). The plunger is brought into the lower position. The alignment tool (3) is then held into the incubation rail. The short spike (4.5mm) has to be placed into the plunger exit position. The flat surface of the alignment gauge should now lie on the base of the incubation rail (4). Otherwise the two set-screws in the fish-plate (7) have to be loosened which allows the plunger to be pushed downwards until the flat surface of the alignment gauge comes to rest on the incubation rail base. The upper flat surface (2) of the plunger has to be 4.5mm deeper than the base of the incubation rail (4).

It must not be possible to move the plunger upwards against the alignment gauge. In this case, the ejector-plunger-position would be too deep.

After completing the alignment, the set-screws have to be tightened again.

Pic. 8.3.3.1



ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.3.4 Checking the Lifting Solenoid of the Incubation Rail

In the incubation rail is a lifting solenoid (see Pic. 8.3.2.1 no.4) which blocks the position 1(ejector position).

The function of the lifting solenoid can be checked with a continuous test program in the **service program**.

The lifting solenoid is activated and then powered off, it should spring out without any delay.

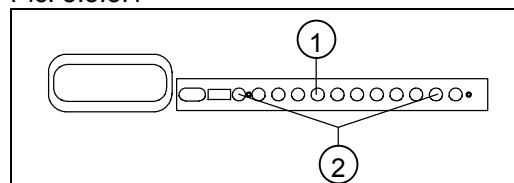


11.3

8.3.5 Adjusting the Temperature of the Incubation Rail

The supply voltage has to be turned on. The adjustment is carried out on the AM-I-HZ (D07401) board. Two cuvettes (2), which are filled with approx. 200 µl water, are placed into the incubation channel (1) (see Pic. 8.3.5.1).

Pic. 8.3.5.1



The theoretical value of the heating is adjusted with the potentiometer **R22**. As long as the LED V1 is lit, the heating is active and the temperature increases. The temperature in the cuvettes should be at 37.5°C ± 0.3°C.



5.4

The actual temperature in the cuvettes can be measured with the liquid thermometer.

1↗ = approx. - 1°C / 1↘ = approx. + 1°C

ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.3.6 Adjusting the PC Temperature Display

The current temperature of the measuring unit can be queried with the **service program**.



11.3

The displayed value is matched to the adjusted value (value displayed on the thermometers) using the potentiometer **R23**.

1↗ = approx. + 0.5°C / 1↘ = approx. - 0.5°C

IMPORTANT!

The temperature displayed on the PC in the service program should always be equal to the true temperature!



8.3.7 Checking the Lifting Solenoids

Before aligning the cuvette magazine the function of the lifting solenoids should be checked (stop pins for the 1st cuvette box).

The lifting solenoids (stop pins for the positioning of the 1st cuvette box) can be “extended” or “retracted” with the service program.



11.3

In the retracted position, the pins have to be sunk completely so that the cuvette boxes can be transported over them without hitting them.

“Extension” of both pins should happen at the same time if possible so that accurate positioning of the cuvette box can be guaranteed. In addition, the lifting solenoids pins should be positioned in the center of the “conveyor 1” plate borings. Should one of the steps not be carried out correctly, the lifting solenoids have to be checked and realigned if necessary.

IMPORTANT!

The lifting solenoids should not be turned on for longer than 30 sec!

**ATTENTION!**

Disregard can lead to malfunction of and cause damage to the AMAX CS-190!



8.3.8 Alignment Tools Magazine

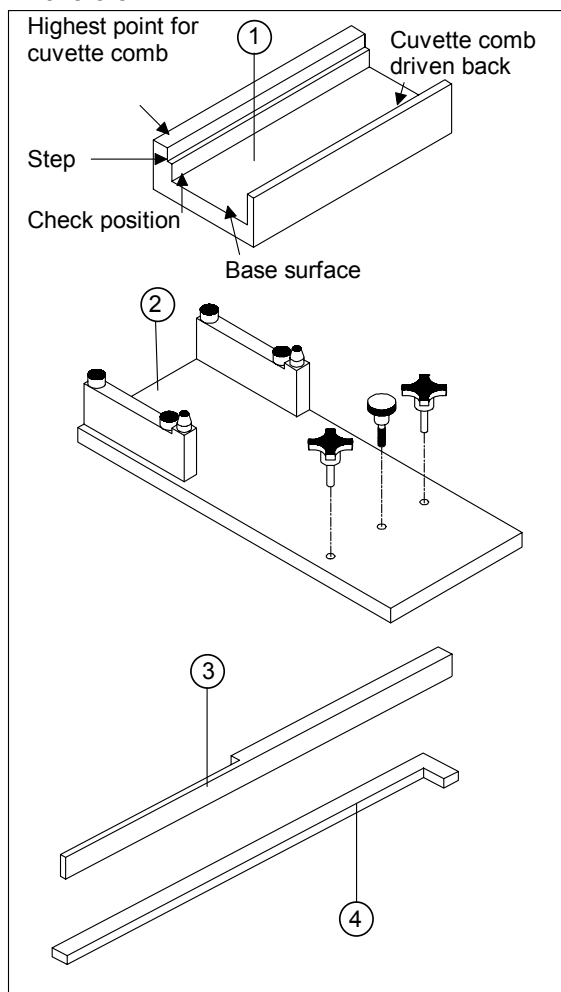
(1)
Alignment gauge I
(magazine light barriers) (J01847)

(2)
Alignment gauge
(Alignment Pusher Unit 1) (J01820)

(3)
Alignment gauge III
(gauge lifting solenoid) (J01819)

(4)
Alignment gauge II
(light barrier for row pusher end position) (J01827)

Pic. 8.3.8.1



IMPORTANT!

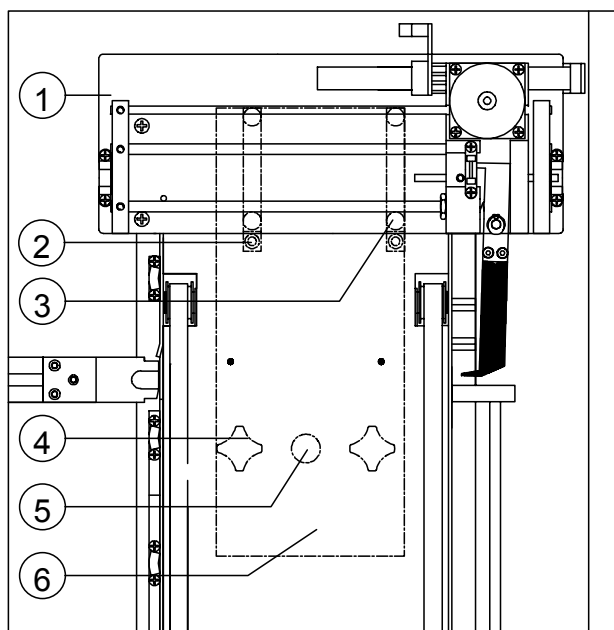
All alignment gauges have to be removed after the alignment!



8.3.9 Adjusting the Pusher 1 Unit

The alignment of the Pusher Unit 1 can be checked after inserting the alignment gauge (6) (J01820) and attaching it with the centering pins (4) and the fastening screw (5). The base plate of Pusher Unit 1(1) should lie on the alignment gauge support points and the whole unit should fit closely to the alignment gauge impellers (2). In order to carry out the alignment, the four M4 nuts have to be unscrewed so that moving the unit is possible. After completing the alignment, tighten the nuts and remove the alignment gauge.

Pic. 8.3.9.1



ATTENTION!

Disregard can lead to malfunction of and cause damage to the AMAX CS-190!



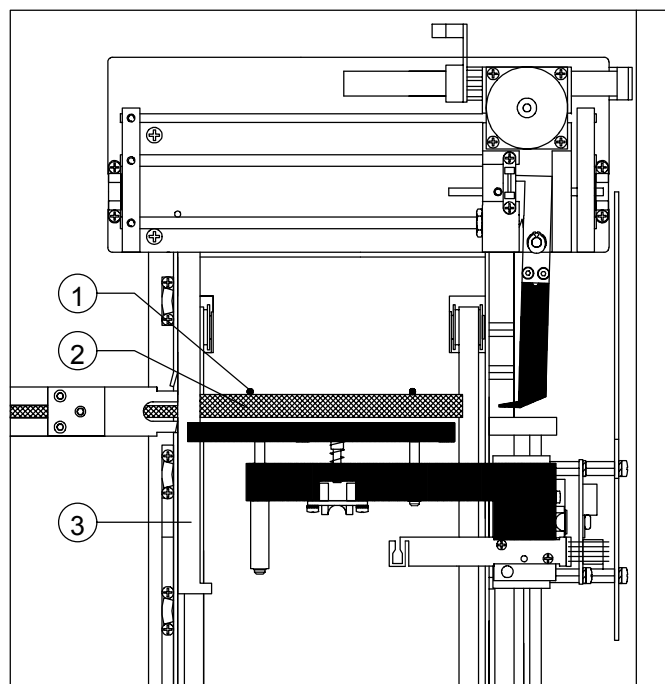
8.3.10 Alignment of the Cuvette Magazine in the AMAX CS-190

The alignment of the complete magazine can be carried out only when the incubation rail (Q10005) has already been mounted to the instrument. The incubation rail has to be mounted as far as possible in the direction of the amplifier unit and the cuvette magazine. Now the alignment gauge (J01819) (gauge III, alignment gauge lifting solenoid) can be inserted into the incubation rail. The cuvette magazine can be moved after unscrewing the fastening screws (3 hexagonal headed screws). The cuvette magazine is now adjusted so that both lifting solenoids (impellers for the 1st cuvette box) fit closely in front of the alignment gauge. At the same time Ensure that the incubation rail gauge III of the does not protrude into the cuvette magazine. For example, if a ruler or the alignment gauge II is put against the inside of the cuvette magazine's left side, the incubation rail gauge III may extend no further than the ruler or the gauge II.

After completing the alignment, both fastening screws have to be tightened again. Perform a function check by pushing the lifting solenoids downwards and releasing them again. They should spring back from the alignment gauge without any delay.

Pic. 8.3.10.1

- Lifting solenoids (1)
- Alignment gauge III (2)
- Alignment gauge II (3)



Alignment check: The row pusher is moved in the direction of the incubation rail. The pusher should be positioned in the middle of the incubation rail opening.

When processing the cuvettes, these should move into the incubation rail in a straight line. The opening in the cuvette box should be in alignment with the opening in the incubation rail.

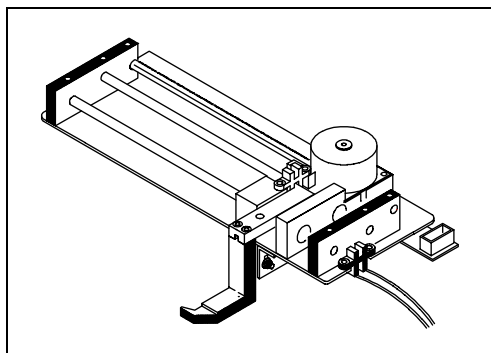
8.3.11 Adjusting the Light Barriers and the Cuvette Comb

The alignments for the light barriers are listed in tab. 8.3.11.1.

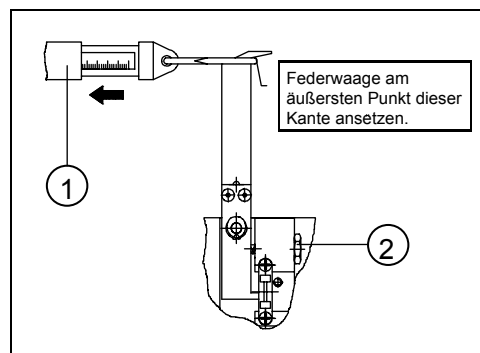
Tab. 8.3.11.1

Light barrier	Position	Alignment
Row pusher see Pic. 8.3.11.1(3)	End	Insert the alignment gauge (J01827) (gauge II, row pusher end light barrier). Gauge II is inserted to the incubation rail end. The light barrier may change its signal (display "High") only when the row pusher touches the alignment gauge II. The alignment can be altered by moving the straight pin (2). For this purpose, the set-screw (M4) (3) in the motor block (1) has to be loosened.
see Pic. 8.3.11.1(2)	Tension	A value of 4N is adjusted with the help of a spring scale (1) (890300). For this purpose, the spring scale has to be attached to the tip of the row pusher. Now hold the pusher 1 in its position while pulling on the spring scale until the desired value is archived. The display of the light barrier has to change then. If it doesn't, the elastic force has to be adjusted with the screw (2) "stop pin".

Pic. 8.3.11.1

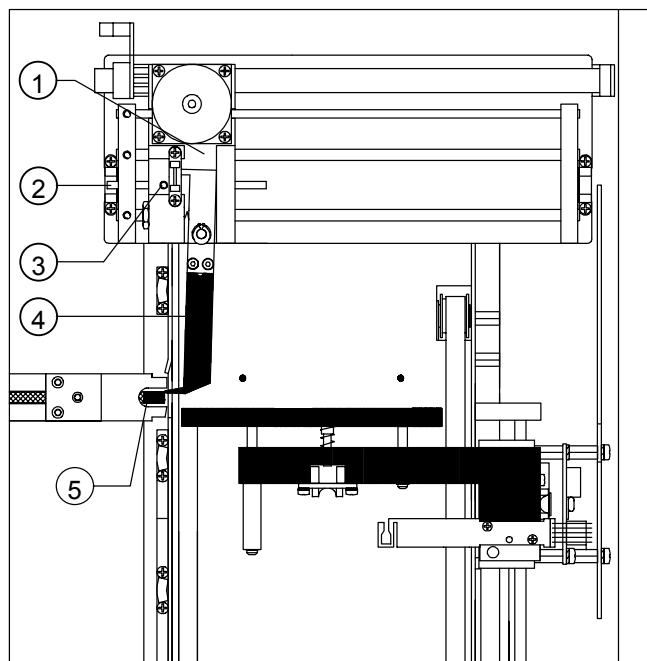


Pic. 8.3.11.2



Pic. 8.3.11.3

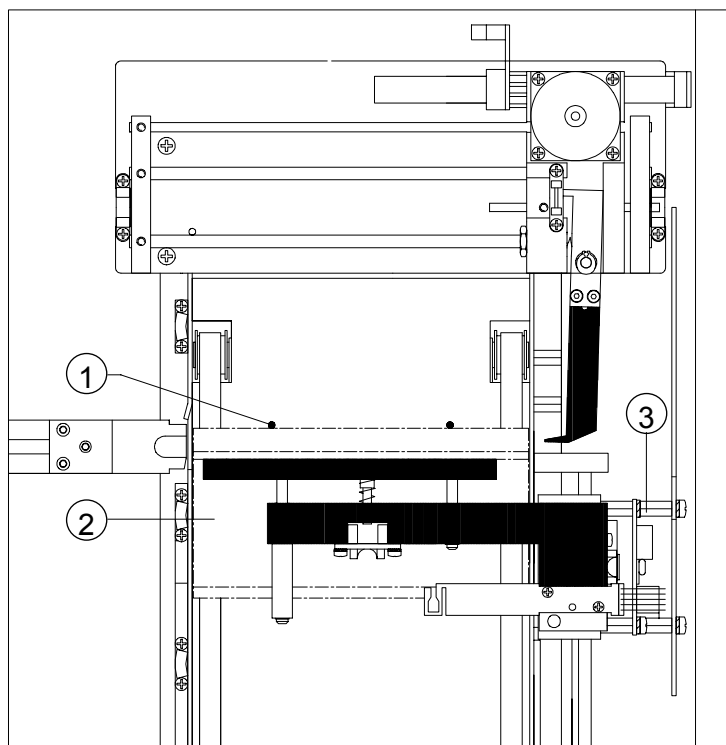
- Motor block (1)
- Straight pin (2)
- Set screw (3)
- Row pusher (4)
- Alignment gauge II (5)
(row pusher end light barrier)



8.3.12 Adjusting the Cuvette Comb

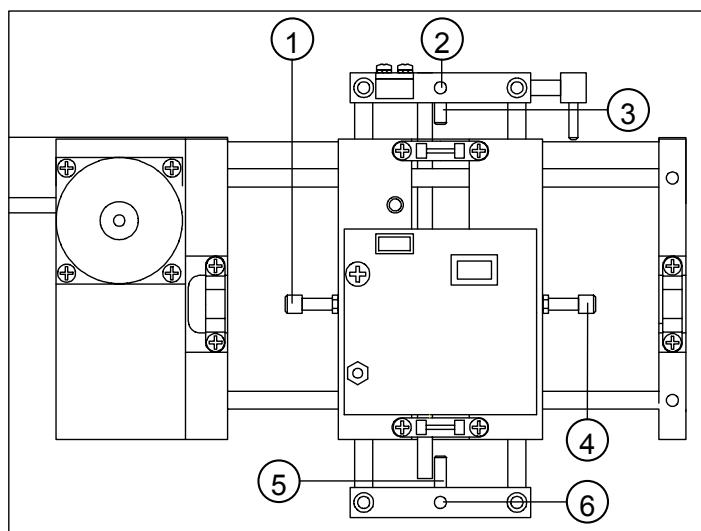
Pic. 8.3.12.1

- Lifting solenoids (1)
- Alignment gauge I (magazine light barriers) (2)
- Pusher 2 unit (3)



Pic. 8.3.12.2 Pusher 2 unit (D10033)

- Straight pin (1)
Alignment: Cuvette comb moved backwards
- Set-screw (2)
- Set-screw (3)
Alignment: Cuvette comb moved downwards
- Straight pin (4)
Alignment: Cuvette comb moved backwards
- Set-screw (5)
Alignment: Cuvette comb moved upwards
- Set-screw (6)

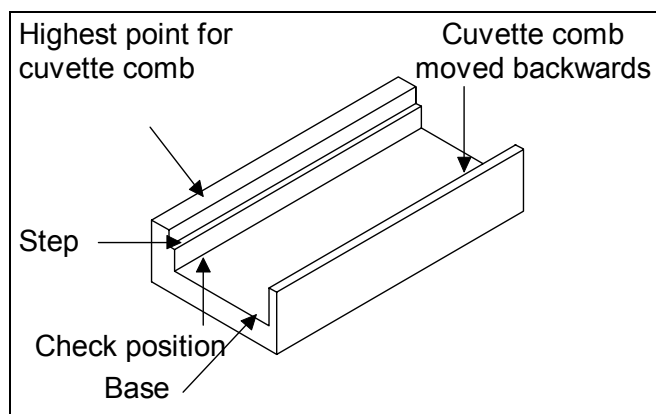


Tab. 8.3.12.1

Light barrier	Position	Alignment
Cuvette comb see Pic. 8.3.12.1 8.3.12.2	moved upwards	Insert the alignment gauge (J01847) (gauge I, magazine light barriers). Pic. 8.3.12.1 The cuvette comb "guide pins" have to be positioned on the highest point (front edge) of the alignment gauge. Only then the signal for the light barrier (Display "Low") may change. The height of the cuvette comb is adjusted with the set-screw (5) seated in the reset bracket. The set-screw (6) has to be unscrewed first. When the screw (5) is loosened, the position is lowered. When the screw (5) is tightened, the position is raised.
see Pic. 8.3.12.3	moved downwards	The alignment is defined by the base of gauge I. That means that the light barrier may change its signal (display "Low") only when the "guide pins" are positioned on the base. The stepper motor switch off position can be adjusted with the set-screw (3). The set-screw (2) must be unscrewed first.

Pic. 8.3.12.3

Alignment gauge I (J01847)
(Magazine light barriers)



Continuation Tab. 8.3.12.1

Light barrier	Position	Alignment
see Pic. 8.3.12.3	moved backwards	This position is used when the cuvette box is changed. The comb must be in the position "Comb moved backwards". The alignment gauge 1 may not be moved from its original position. The position is aligned with the fillister head screw seated in motor block 1 of pusher unit 2.
see Pic. 8.3.12.3	in back position	The cuvette comb "guide pins" have to be positioned on the alignment gauge step. The light barrier signal (display "Low") the must change when the comb is pushed against the step. The position is aligned with the fillister head screw seated in motor block 1 of the pusher 2 unit.

Check: The check position of the alignment gauge is calculated so that when the comb is in the "Comb moved backwards" position, the light barriers "Comb moved backwards" and "Comb under tension" change their signal (display "Low") at the same time. Ensure to smooth running of the spring tension beam.

ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.3.13 Checking the Reflex Light Barriers

Three reflex light barriers are positioned at the left side of the cuvette magazine (user position in front of the instrument). These light barriers monitor the cuvette boxes on the conveyors.

The function check can be carried out with the **service program**.



11.3

A cuvette box is positioned in front of a single light barrier. The corresponding display in the **service program** has to change its status. The reflex light barrier "magazine jam disposal" is positioned in the lower part of the cuvette magazine (disposal chute). Ensure correct allocation of the light barriers.

1. Light barrier "Magazine supply"
2. Light barrier "Magazine front"
3. Light barrier "Magazine jam disposal"

8.3.14 Checking the Conveyors

The conveyors can be turned on and off with the **service program**.



11.3

Ensure that the supply and the disposal conveyor belts are moving in the correct direction. When the conveyors are operating, a “clean”, “smooth” running noise should be audible. Otherwise, check the tension of each conveyor belt and adjust it if necessary. The driving tapered cogwheels must intermesh perfectly, correct if necessary. The tapered cogwheels must be lubricated.

IMPORTANT!

The conveyors should not be turned on for longer than 30 sec.



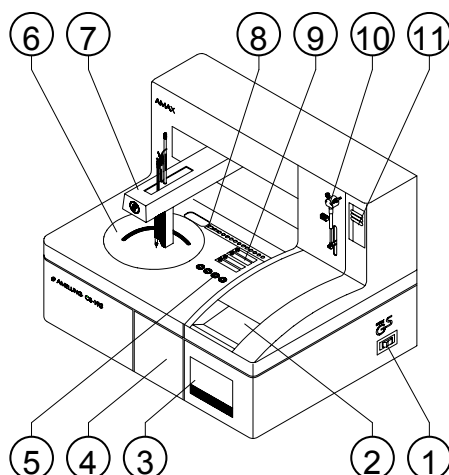
ATTENTION!

Disregard can lead to malfunction of and cause damage to the AMAX CS-190!



8.4 Reagent-Plasma-Barcode

Pic. 8.4.1
RPB (6)



Tab. 8.4.1 Structure RPB (Q10004)

electronic subassemblies	
AM-RPB board	(D01101)
PH-MCK II board	(D03601)
PH-TF board	(D08501)
Cover sensor comp.	(Q90022)

There is a dip-switch for adjusting the module address on the PH-MCK board. It also contains the program-IC (integrated chip) IC1, which can be replaced to update to a new program version.

The following dip-switch adjustments have to be carried out so that the module can be identified.

Tab. 8.4.2

Dip-switch S1	Position
Switch no. 1	off
Switch no. 2	on
Switch no. 3	on
Switch no. 4	off
Module address: 6	

ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.4.1 Adjusting the Cooling Circuits

IMPORTANT!

This adjustment may be carried out only when the instrument is switched on, that means only when the cooling circuit is working



In order to carry out the adjustment, the following instrument casings have to be removed:

Side casing left	(123289)
Front plate left	(123293)

The adjustment is carried out on the PH-R2R (D06101) board. The actual temperature value of the cooling is adjusted with potentiometer **P1**.

1↗ = approx. - 1.0°C / 1↘ = approx. + 1.0°C

The cooling is active and the temperature decreases as long as the LED V3 is lit. The actual temperature is measured with a contact thermometer on the aluminium-block.

When the LED V3 has gone out, the temperature should be at 16.5°C ± 1.5°C.



5.4

ATTENTION!

Disregard can lead to malfunction of and cause damage to the AMAX CS-190!



8.4.2 Adjusting the PC Temperature Display

The adjustment is carried out on the PH-TF (D06801) board.

The actual temperature of the measuring block can be queried with the **service program**.



11.4

The displayed value can be altered (adjusted) with the potentiometer **R7**.

1↗ = approx. - 0.5°C / 1↘ = approx. + 0.5°C

The temperature of the side surface of the aluminium-ring should be measured with a contact thermometer. Then it should be adjusted to this value: ca. 16.5°C.

IMPORTANT!

The temperature displayed by the PC in the service program should always be equivalent to the actual temperature.

**ATTENTION!**

Disregard can lead to malfunction of the AMAX CS-190!



8.4.3 Adjusting the Cutoff Voltage of the Servo Power Amplifier

In order to carry out the adjustment, the following instrument casings have to be removed:

Side casing left (123289)

The voltage is measured at PIN 2 of IC 7 (IC LM 311) on the AM-RPB (D00301) board against ground with a multimeter. A voltage of approx. 1.1 volts is adjusted with the potentiometer **R19**.

$1\text{⤴} = \text{approx. } + 200\text{mV} / 1\text{⤵} = \text{approx. } - 200\text{mV}$

In order to make a function check, the rotor is moved manually. Resistance can be felt and the operating noise of the motor becomes audible. When the pressure is increased, the rotor movement must be effortless.

The cutoff has been activated. The LED V5 has gone out and the relay REL1 has opened.

The adjustment can be checked in the **service program** by running the test routine for the reagent-plasma-tray (the connection: Reagent-plasma-tray and commander PC must be established).



11.4

Here, the cutoff must not activated, otherwise the voltage at PIN 2 of IC 7 must be increased.

8.4.4 Adjusting the Mixer Voltage

The measured and adjusted voltage is proportional to the mixer voltage. Therefore the voltage is measured at PIN 15 of IC 10 (L297) with a digital multimeter. The voltage value is adjusted to a max. of 0.200 volts with potentiometer **R24**.

$1\text{⤴} = + 120\text{mV} / 1\text{⤵} = - 120\text{mV}$

To check the mixer vials each containing a magnetic flea is placed in the reagent tray on positions 9, 17 and 18. The magnetic flea must rotate on all a.m. positions.

ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.4.5 Mechanical Reset Adjustments at the RPB

In order to carry out the adjustments, the instrument must be switched on and connected to the commander PC.



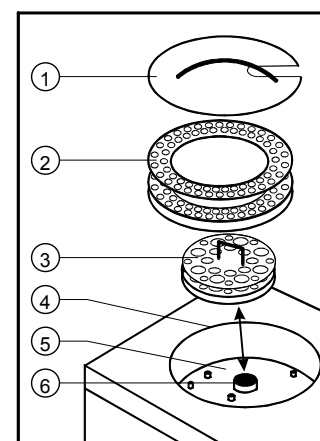
7.5

The reset position must be adjusted so that the indent at rotor (2) (plasma ring) coincides with the indent of the ALU-ring (4) (cooling) after the reset operation.

First the reagent tray (3) is taken out of the reagent-plasma-cavity in order to unscrew the set-screws which are screwed into the core (6). Now the tray (5) can be turned on its axis so that the position can be changed. After each change, the set-screws have to be tightened again. The reagent plasma tray must carry out a reset so the new reset position will be obtained.

When the indents coincide, the adjustment is complete.

Pic. 8.4.5.1



8.4.6 Adjusting the Barcode Scanner Position

The lateral position of the barcode scanner can be altered by loosening the plate angle fastening screws. The scanner can now be positioned facing or opposing the ALU-ring after the barcode scanner fastening screws have been unscrewed.

A scanning operation can be started with the **service program**. Position a monovette in the outer plasma ring. The position of the scanner has

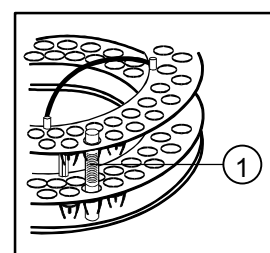
to be adjusted so that the laser beam moves centrally across the monovette (1). The operation then has to be repeated, this time with a monovette in the second plasma ring.

Finally, a monovette with a barcode label is placed in the plasma ring and a new scanning operation is started. When the barcode is read successfully, the adjustment is complete. The screws have to be tightened again.



11.4

Pic. 8.4.6.1



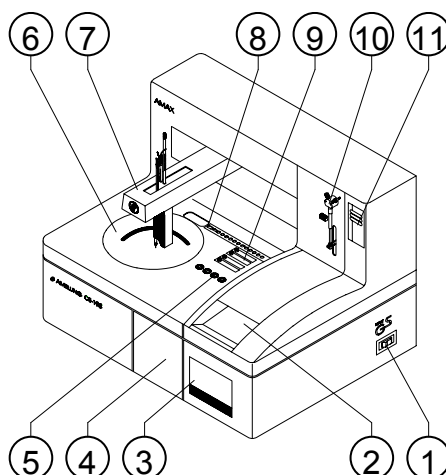
ATTENTION!

Disregard can lead to malfunction of and cause damage to the
AMAX CS-190!



8.5 Photometer

Pic. 8.5.1
Photometer (9)



Tab. 8.5.1 Structure photometer (Q10010)

mechanical subassemblies	
Amplifier	(Q10050)
Lamp casing	(D10085)
Measuring unit	(D10087)
Light voltage regulator	(Q10015)

The module address is adjusted on the PH-O-RK board. It is positioned in the subassembly: computer board unit (Q10082).

There are two dip-switches for adjusting the module address on the PH-O-RK board. It also holds the program-IC (integrated chip) IC1, which can be replaced to update to a new program version.

The following dip-switch adjustments have to be carried out so that the module can be identified:

Tab. 8.5.2

Dip-switch S1	Position	Dip-switch S2	Position
switch no. 1	on	switch no. 1	off
switch no. 2	on	switch no. 2	off
switch no. 3	on	switch no. 3	off
switch no. 4	off	switch no. 4	off
Module address: 7			

ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.5.1 Removing the Measuring Unit

In order to remove the measuring unit, the following instrument casings have to be removed:

Upper structure	(123290)
Side casing left	(123289)
Work area	(123292)
Front plate left	(123293)
Side casing right	(123291)
Front plate right	(123294)
Magazine cover	(122432)

8.5.2 Adjusting the Temperature of each Measuring Channel

In order to carry out the adjustments, the following instrument casings have to be removed:

Upper structure	(123290)
Side casing left	(123289)
Work area	(123292)

Adjustment is carried out on the PH-O-HZ (D06501) board which is mounted on every measuring channel. A cuvette filled with 200 µl water is placed into each photometer measuring channel. The supply voltage must be switched on. The adjustment can be carried out outside of the instrument as well. Pay attention that the photometer is not surrounded with cold air (avoid draft). The actual temperature value of the heating is adjusted with the potentiometer **R1** (accessible through the upper plate of the photometer).

1↗ = approx. + 1°C / 1↘ = approx. - 1°C

The heating is active and the temperature increases as long as the light emitting diode LED V1 (cannot always be seen) is lit. The actual temperature can be measured in the cuvette with the liquid thermometer.

When LED V1 has gone out (after approx. 15 minutes), the temperature should be at 37.5°C ± 0.3°C.



5.4

After each change of the actual value wait at least 5 minutes before reading the actual value.

The adjustment process is complete as soon as the temperature in the cuvette is constant.

ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.5.3 Adjusting the Photometer Lamp Voltage

In order to carry out the adjustment, the following instrument casings have to be removed:

Side casing left (123289)

The lamp is switched on with the *service program*.



11.5

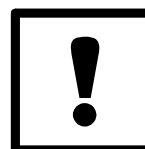
The lamp voltage is adjusted on the AM-O-LSR (D08401) board with potentiometer **R50**.

1↗ = approx. - 200mV / 1↘ = approx. + 200mV

The voltage to be adjusted can be measured at the points X5 & X6 (lamp cable connection) with a digital multimeter. The voltage should be 11.0 ± 0.5 volts.

ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.5.4 Adjusting the Photometer Measuring Amplifier

In order to carry out the adjustment, the following instrument casings have to be removed:

Upper structure (123290)

Side casing left (123289)

Working area (123292)

The calibration should be carried out inside the instrument (photometer installed). The measuring unit has to be protected from outside light sources. The disposal drawer has to be closed. The temperature and the lamp voltage have to be adjusted correctly. Otherwise the temperature and voltage adjustment of the photometer lamp have to be carried out first.

The AMAX CS-190 has to be connected to the commander PC.



7.5

Offset calibration

The voltages of each measuring amplifier can be queried with the **service program** for the photometer. (Amplifier compl. (Q10150)).



11.5

Start the **service program** and carry out a reset by pressing <F10>, load the program with <F7> (Enter: photonp.bin), start the measuring program with <F9> and access the displays of the channels with <F6>-<6>,<7> or <8>. The parameters are entered.

Base voltage: 0 / Multiplier: 1000

The channels are adjusted with the *offset potentiometer* (lower potentiometer) so that all curves on the screen are positioned between 0.0005 und 0.001 volts (approx. 5-10 digits).

1↗ = approx. + 4.5mV(ca. + 28 Digits) / 1↘ = approx. - 4.5mV(ca. - 28 Digits)

Amplification calibration

IMPORTANT!

No cuvettes may be positioned in the measuring channel!



Now the photometer lamp is started with **service program** for the photometer.



11.5

Press <F9> to start the measuring program, then switch on the lamp with <F4> and wait 3 minutes, then press <F6>-<6>,<7> or <8> to access the displays of the channels. The parameters are entered.

Base voltage: 8.2 / Multiplier: 100

The channels are adjusted with the *amplifier potentiometer* (upper potentiometer) so that all lines on the screen level out at 8.25 ± 0.1 volts (approx. 54000 digits).

1↗ = approx. + 225mV(ca. + 1800 Digits) / 1↘ = approx. - 225mV(ca. - 1800 Digits)

IMPORTANT!

If this value cannot be adjusted, that means when the range between high and low is too small, the following steps have to be carried out:

1. When the values are too low, first clean the photometer measuring channels. When no change can be determined,



- alter the lamp voltage (increase).
2. When the values are too high, decrease the lamp voltage.

In the **service program** the adjustment is displayed with a graphic.



11.5

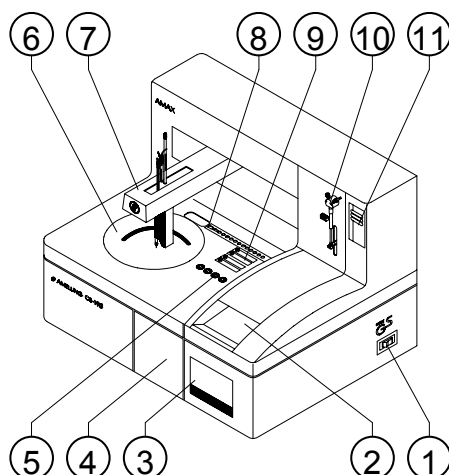
ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.6 XYZZ-Robot (gantry)

Pic. 8.6.1
XYZZ-robot (7)
(gantry)



Tab. 8.6.1 Structure XYZZ-robot (gantry) (Q10009)

mechanical subassemblies		electronic subassemblies	
Motor block	(D10020)	PH-X-ADA2 board	(D01302)
Ball bearing mounting	(Q10031)	PH-RC board	(D01401)
End ball bearing	(D10021)		
Needle heating	(D10044)		

The PH-MCK II board sits on the PH-XYZZ board, which is mounted to the plate: board unit XYZZ-AM-F2 (Q10085).

There is a dip-switch for adjusting the module address on the PH-MCK II board. It also holds the program-IC (integrated chip) IC1, which can be replaced to update to a new program version.

The following dip-switch adjustments have to be carried out so that the module can be identified:

Tab. 8.6.2

Dip-switch S1	Position
switch no. 1	off
switch no. 2	off
switch no. 3	off
switch no. 4	on
Module address: 8	

ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.6.1 Adjusting the Safety Systems of the Control Unit

In order to carry out the adjustment, the following instrument casing has to be removed:

Rear casing (123268)

In order to carry out the adjustment, the instrument has to be switched on and connected to the commander PC.



7.5

IMPORTANT!

There are multiple safety systems for the robot gantry on the PH-XYZZ (D00101) board. These safety systems protect the user from movements of the gantry in case he gets in the way of the robot. This makes it important to carry out the following adjustments with great care.



8.6.2 Voltage Cutoff of the X-Motor Amplifier

The voltage is measured at PIN 5 of IC 20 on the PH-XYZZ board with a multimeter against ground. A voltage of approx. 1.53 volts is adjusted with the potentiometer **R29** (Imprint on the board: **I-X**).

1↗ = approx. + 200mV / 1↘ = approx. - 200mV

In order to carry out a function check the robot gantry is manually pushed to the left or the right in X-direction. Resistance can be felt and the operation noise of the motor becomes audible. After pushing harder, the gantry must move effortlessly.

IMPORTANT!

Both Z-axis are powered off as well and might move downwards. This may cause damage!



The safety cutoff has activated, the robot gantry has been powered off. The light emitting diode (LED) V21 has gone out on the PH-XYZZ board and the relay has opened.

Now switch the instrument off and on (resets the cutoff system).

ATTENTION!

Do not switch the instrument on and off in short sequence (wait approx. 10-15 seconds).

Disregard can lead to malfunction of and cause damage to the



AMAX CS-190!

8.6.3 Voltage Cutoff of the Y-Amplifier

The voltage is measured at PIN 9 of IC 20 on the PH-XYZZ board with a digital multimeter against ground. A voltage of approx. 0.75 volts is adjusted with the potentiometer **R58** (Imprint on the board: **I-Y**).

1↗ = approx. + 200mV / 1↘ = approx. - 200mV

In order to carry out a function check the robot gantry is manually pushed in Y-direction. Resistance can be felt and the operation noise of the motor becomes audible. After pushing harder, the gantry must be moved effortlessly.

IMPORTANT!

Both Z-axis are also powered off and might move downwards.
This may cause damage!



The safety cutoff has activated, the robot gantry has been powered off. The light emitting diode (LED) V21 has gone out on the PH-XYZZ board and the relay has opened.

Now switch the instrument off and on (resets the cutoff system).

ATTENTION!

Do not switch the instrument on and off in short sequence
(wait approx. 10-15 seconds).

Disregard can lead to malfunction of and cause damage to the
AMAX CS-190!



8.6.4 Speed Cutoff of the X-Motor Amplifier

The voltage is measured at PIN 7 of IC 20 on the PH-XYZZ board with a digital multimeter against ground. A voltage of approx. 1.4 volts is adjusted with the potentiometer **R57** (Imprint on the board: **V-X**).

$1\uparrow = \text{approx. } + 180\text{mV} / 1\downarrow = \text{approx. } - 180\text{mV}$

In order to carry out a function check the **service program** "XYZZ-robot" has to be accessed and used to power off the robot-axes. The gantry then can be moved effortlessly.



11.6

IMPORTANT!

Both Z-axis are also powered off and might move downwards.
This may cause damage!



The robot X-sledge now has to be moved all the way to the left to its reset position.

IMPORTANT!

Both Z-axes have to be positioned at the upper stops.



From the reset position, the sledge is accelerated manually as fast as possible. When it reaches a certain speed, the amplifier switches off. The light emitting diode (LED) V21 on the PH-XYZZ board has gone out and the relay has opened.

Now switch the instrument off and on (resets the cutoff system).

ATTENTION!

Do not switch the instrument on and off in short sequence
(wait approx. 10-15 seconds).

Disregard can lead to malfunction of and cause damage to the
AMAX CS-190!



In order to carry out a function check of the XYZZ-robot after the adjustments, a test routine (in the **service program** "Test routine XYZZ-axes") or a self test has to be run.



11.6
11.14

IMPORTANT!

Should the gantry turn itself off during normal movement, the adjustment is over-sensitive. The adjustment has to be corrected. Also check the guide rails for sluggishness and lubricate them if necessary.



ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



8.6.5 Mechanical Reset Adjustment of the XYZZ-Robot

When the operating voltage is turned on, the robot moves to its reference position. All XYZZ-units have to move: The Z-axes move to the upper stops in sequence, then the Y-unit moves into the light barrier, then the X-motor starts moving. As soon as it has also reached its light barrier, all motors simultaneously start moving abruptly in order to check the belts' tension. Then all axes move back to their reference positions until the XYZZ-gantry comes to a stop over the incubation rail. This also is the home position.

Should the XYZZ-robot not come to a stop there, there are several possible reasons:

Light barrier(s) defect, safety cutoff has activated, belts torn, reset light barrier recognition not adjusted, etc.

Example: Only one sledge moves, e.g. both axes move to the upper stops and then the Y-axis moves into its light barrier. Then nothing moves any more, the next unit should then be checked (X-motor).

ATTENTION!

Do not switch the instrument on and off in short sequence (wait approx. 10-15 seconds).

Disregard can lead to malfunction of and cause damage to the AMAX CS-190!



In order to carry out the following adjustments, the following instrument casings have to be removed:

Casing Y-gantry	(122579)
Rear casing	(123268)

The voltage supply unit has to be tilted upwards and secured.

8.6.6 Adjusting the XY-Motors

The mechanical adjustment position of the XYZZ-robot is mechanical measuring channel 4.

Ball position 4 with the cuvette ejector is obtained using the **service program**.



11.6

IMPORTANT!

The XY-positions of the Z-axes should be about right before the adjustment. If they are not, the Z2-axis may touch the rim of the measuring channel. The cutoff of the Z-motors could be activated.



In order to adjust the X-position, the screw on the clip “light barrier” on the X-sledge (Q10008) is unscrewed. With it, the X-position is altered.

In order to adjust the Y-position, the screw on the clip “light barrier adjustment” on the ball bearing mounting (Y-axis) (Q10031) is unscrewed. The position can be altered by moving the metal flag.

Tighten the screws after each change.

Use the **service program** to carry out a reset of the XYZZ-robot and then obtain the position again.



11.6

If the ejector reaches position 4 successfully, the XY-motor adjustment is complete.

When all motors (sledges) are at their reference positions the “Teach in” must be checked.



11.10

IMPORTANT!

After each light barrier adjustment, the robot must move back to its reference position. Otherwise, the altered adjustment is not effective.



ATTENTION!

Do not switch the instrument on and off in short sequence (wait approx. 10-15 seconds).

Disregard can lead to malfunction of and cause damage to the AMAX CS-190!



8.6.7 Adjusting the Level Sensors (liquid level sensors and height sensors)

The PH-LSX board is positioned at the side wall of the subassembly: Dilutor-unit (Q10007)

In order to carry out the adjustment, the following instrument casings have to be removed:

Upper structure	(123290)
Shield plate	(123203)

1. Solder bridge X1 using a soldering iron and solder. The amplitude of the HF-oscillator is checked by connecting the oscilloscope to the measuring point MP1 and earth. The oscillator is adjusted to a default amplitude of 4Vss with the potentiometer R33.

↗ = - / ↘ = +

2. Adjusting the amplitude of both Z-axes:

The oscilloscope is connected to PIN X5 or X7. An amplitude of 600mVss is adjusted with the potentiometer R31.

↗ = - / ↘ = +

3. Adjusting the input amplitude (remaining circuit):

A digital multimeter is connected to MP 4 and a voltage of 3 volts $\pm$ 0.1V is adjusted.

↗ = - / ↘ = +

The circuit is now operational. A voltage of approx. 700mVss can be measured with the oscilloscope at the measuring point MP2 after a successful adjustment. At MP3, approx. 3.5Vss can be measured. In order to check it, touch the Z-axis with your fingers. Then LED V9 should light up.

The sensors can also be checked with the **service program**.



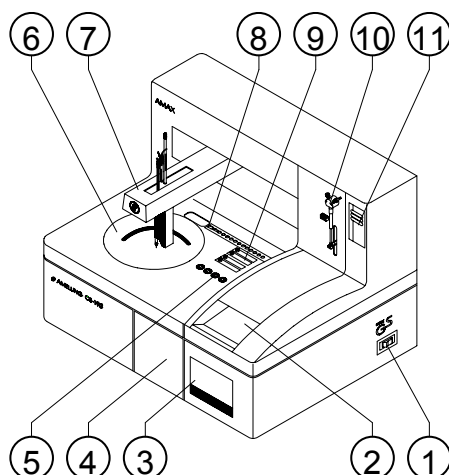
11.6

ATTENTION!

Disregard can lead to malfunction of and cause damage to the
AMAX CS-190!



8.7 Water Temperatures



Pic. 8.7.1

Tab. 8.7.1 Structure water tempering (Q10013)

mechanical subassemblies		electronic subassemblies	
water reservoirs II	(D10068)	PH-H2O board	(D00901)
		PH-MCK board	(D00801)

There is a dip-switch for adjusting the module address on the PH-MCK board. It also contains the program-IC (integrated chip) IC1, which can be replaced to update to a new program version.

The following dip-switch adjustments have to be carried out so that the module can be identified:

Tab. 8.7.2

Dip-switch S1	Position
switch no. 1	on
switch no. 2	off
switch no. 3	off
switch no. 4	on
Module address: 9	

ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



In order to carry out the following adjustments, the following instrument casings have to be removed:

Rear casing (123268)

8.7.1 Adjusting the Water Reservoir II Temperature (D10068)

The theoretical value of the heating is adjusted with the potentiometer **R16** on the PH-I-HZ II (D01101) board which sits under the water reservoir.

1↗ = approx. - 1.0°C / 1↘ = approx. + 1.0°C

The heating is active and the temperature increases as long as the LED V1 is lit. The temperature of the reservoir has to be 41°C ± 0.5°C.



5.4

The temperature of the reservoir is measured with a contact thermometer on the brass plate (base plate of the reservoir).

8.7.2 Adjusting the PC Temperature Display

The adjustment is carried out on the PH-TF (D06801) board which is mounted under the water reservoir II.

The actual temperature of the water reservoir II can be queried with the **service program**.



11.7

The displayed value is altered (adjusted) with the potentiometer **R7**.

1↗ = approx. - 0.5°C / 1↘ = approx. + 0.5°C

The temperature is measured with a contact thermometer on the brass plate (base plate of the reservoir). Then the measured value is adjusted.

IMPORTANT!

The temperature displayed by the PC in the service program should always be equivalent to the actual temperature.



ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



9. Maintenance

9.1	Refilling the System Fluids	9 – 1
9.2	Cleaning the Air Filter	9 – 2
9.3	Replacing the Photometer Lamp	9 – 3
9.3.1	Removing the Photometer Lamp	9 – 3
9.3.2	Inserting a New Lamp	9 – 4
9.4	Dilutor Syringe	9 – 5
9.4.1	Removing the Dilutor Syringe	9 – 5
9.4.2	Replacing the Teflon Seal	9 – 6
9.5	Cleaning the Photometer Channels	9 – 7
9.6	Pump Tubing, Waste Water Pump	9 – 8
9.7	Needle XYZZ-Robot	9 – 9
9.7.1	Replacing the Needle	9 – 9
9.7.2	Installing a New Needle	9 – 10
9.8	Cuvette Waste Drawer	9 – 11

9.1 Refilling the System Fluids

The AMAX CS-190 features two fluid circuits, each containing a system fluid. There is a cooling circuit and a 37°C circuit. The fluid is stored in a central storage reservoir. The software monitors the fluid level in the reservoir. In case of a fluid deficiency, a message will be displayed on the screen.

The filling neck is positioned on the top left corner of the rear of the instrument (assuming user is located in front of the instrument).

Lacking system fluid is refilled as follows:

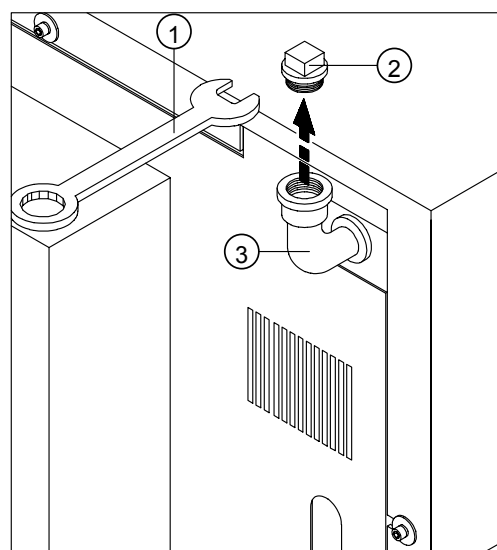
IMPORTANT!

The AMAX CS-190 should be switched off and at the same time be up to operating temperature.



1. Switch off instrument
2. Open filling neck (3)
(loosen screw (2) with an open jaw spanner (1) size 13mm and remove it)
3. Refill system fluid
(830040) 500ml bottle
Refill the system fluid using a funnel.
Pour in Fluid until it becomes visible in the bend of the filling neck (3)
4. Close filler neck (3)

Pic. 9.1.1



The system fluid levels can also be monitored by the **service software**.



11.7

ATTENTION!

Spilled fluid is to be removed immediately.
Disregard may lead to malfunction of and cause damage to the AMAX CS-190!



9.2 Cleaning the Air Filter

The air filter removes dirt particles from the air passing through the air intake. If the filter element is polluted by dust particles, the cooling air flow rate will be insufficient. This makes it necessary to clean the filter once every week.

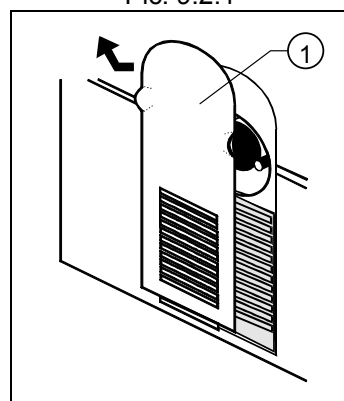
The filter element is positioned on the left side of the instrument (user's location in front of the instrument) and behind the ventilation sheet metal.

In order to reach the air filter (filter fabric (120396)), the following steps have to be carried out:

1. Switch off instrument

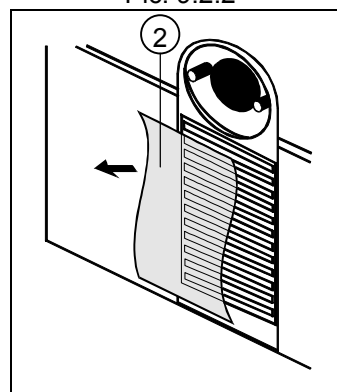
2. Remove ventilator cover (1)

Pic. 9.2.1



3. Remove air filter (2)

Pic. 9.2.2



Now the filter can be patted clean. In case of major pollution it should be washed out. After the washing, insert dry filter.

ATTENTION!

Disregard may lead to malfunction of and cause damage to the AMAX CS-190!



9.3 Replacing the Photometer Lamp

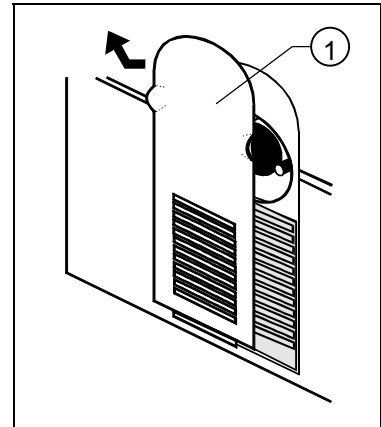
The photometer lamp (247410) is positioned on the left side of the instrument (user's location in front of the instrument), behind the ventilator cover.

9.3.1 Removing the Photometer Lamp

1. Switch off the instrument

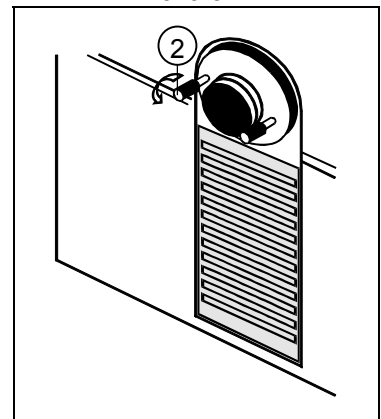
2. Remove ventilator cover (1)

Pic. 9.3.1.1



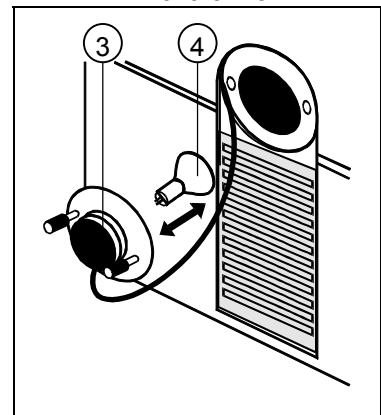
3. Loosen both knurled screws (2) on the lamp casing cover in anticlockwise direction.

Pic. 9.3.1.2



4. Extract the lampholder (3)

Pic. 9.3.1.3



5. Remove the lamp (4) from the lampholder (3):
Hold the cover with one hand while pulling the lamp out of the lampholder with the other hand.

In order to exchange the lamp, the following steps have to be carried out:

ATTENTION!

Lamp and lamp cover can be hot.
Danger of Burns!



ATTENTION!

Don't pull on the lamp cable!



9.3.2 Inserting a New Lamp

1. Pick up the lamp with a suitable, anti-static rag or cloth and insert the lamp into the holder.
2. Tighten both knurled screws on the lamp casing cover in clockwise direction.
3. Functionality of the photometer can be checked with the **service program**.
4. In the user software (main menu), select "Service", then "Calibrate photometer".

ATTENTION!

Do not touch the lamp or the inside of the reflector with the fingers. The fingerprints can destroy the lamp.

In case the lamp or the reflector were touched, immediately clean them with pure alcohol.

Only the original type of lamp should be used.

Disregard may lead to malfunction of and cause damage to the AMAX CS-190!



9.4 Dilutor Syringe

9.4.1 Removing the Dilutor Syringe

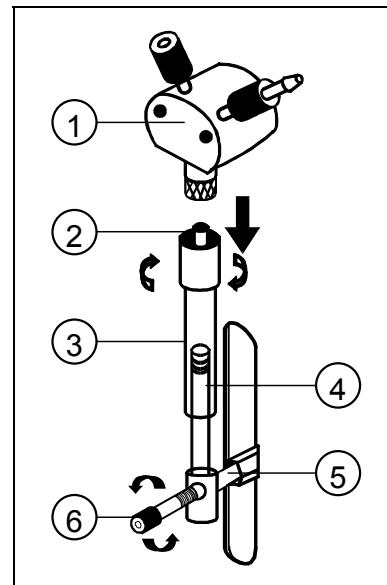
The dilutor syringe (290007) (500µl) should always be changed or cleaned when leaks occur or bubbles appear in the glass cylinder.

In the user software (main menu), select “**Service**”, then “**Move syringe**”. This will move the dilutor syringe to its lowest position.

The syringe can now be removed as follows:

1. Loosen knurled screw (6) in anticlockwise direction.
2. Unscrew syringe cylinder (3) (glass cylinder with threaded tip) in anticlockwise direction off the dilutor head (valve) (1).
3. Remove syringe.

Pic. 9.4.1.1



Pull the plunger rod (4) of the syringe out of the glass cylinder (3). Both parts are put into a container filled with distilled water and boiled for 5 - 10 minutes. Insert the plunger rod (4) back into the glass cylinder (3). To ease movement its sliding, the plunger rod is moistened with water or the cylinder is filled with a little distilled water.

IMPORTANT!

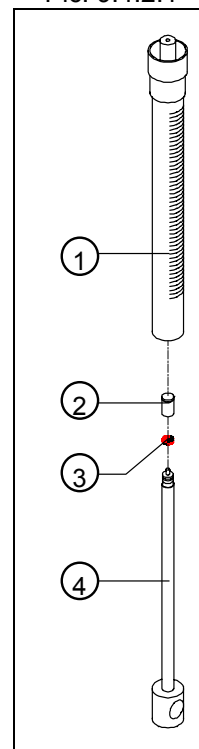
When the plunger was boiled 3 - 5 times, it has to be replaced.
If necessary, the complete syringe has to be replaced.



9.4.2 Replacing the Teflon Seal

1. Remove old teflon seal (2) by pulling it off the plunger rod (4). Use a pair of pliers.
2. The O-ring (3) also has to be removed.
3. Put a new O-ring (2) (350121) on the plunger rod (4).
4. Slide the new teflon seal (2) (350350) over the O-ring (3) and onto the plunger rod (4). The seal has to be slid onto the plunger rod up to the stoppers.
5. Insert the plunger rod (4) into the glass cylinder.
Moisten the plunger with a little water or fill the cylinder with a little distilled water.

Pic. 9.4.2.1



The installation of the syringe is carried out in the reversed order.
Also see Pic. 9.4.1.1.

ATTENTION!

The plunger must move freely.

⇒ Risk of fracturing the glass cylinder.

The threaded tip (2) (Pic. 9.4.1.1) may only be screwed
hand-tight.



In the user software (main menu), select “**Maintenance**”, then “**Wash**” or “**Fill**”. The dilutor should now be washed until no more bubbles are visible.

ATTENTION!

Disregard may lead to malfunction of and cause damage to the
AMAX CS-190!

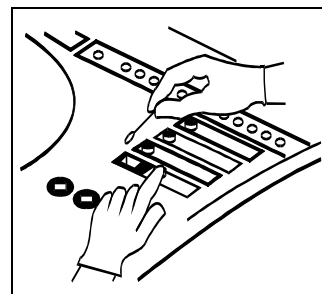


9.5 Cleaning the Photometer Channels

After some time, it is necessary to clean the photometer channels. Deposits on the photometer optics may lead to malfunction.

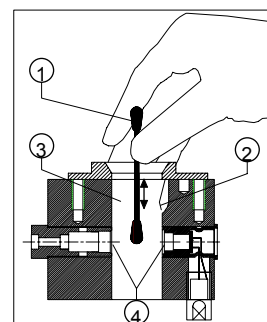
1. Switch off instrument.
2. Open the photometer channel.
3. Clean the photometer optics.
(see Pic. 9.5.2)

Pic. 9.5.1



Pic. 9.5.2

Clean the photometer optics (4) in the cuvette shaft using a cotton wool stick (1) soaked with water. Use up- and downwards movements for cleaning.

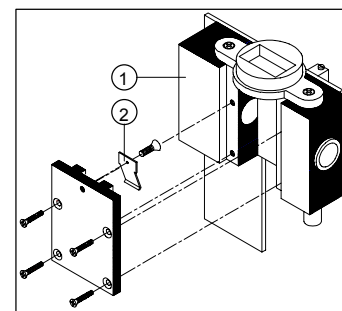


Cuvette retaining spring (2)

Pic. 9.5.3

Photometer channel (1)

Cuvette retaining spring (2)



ATTENTION!

The cuvette retaining springs (2) in pic. 9.5.2(3) must not be bent.

Disregard may lead to malfunction of and cause damage to the AMAX CS-190!



9.6 Pump Tubing, Waste Water Pump

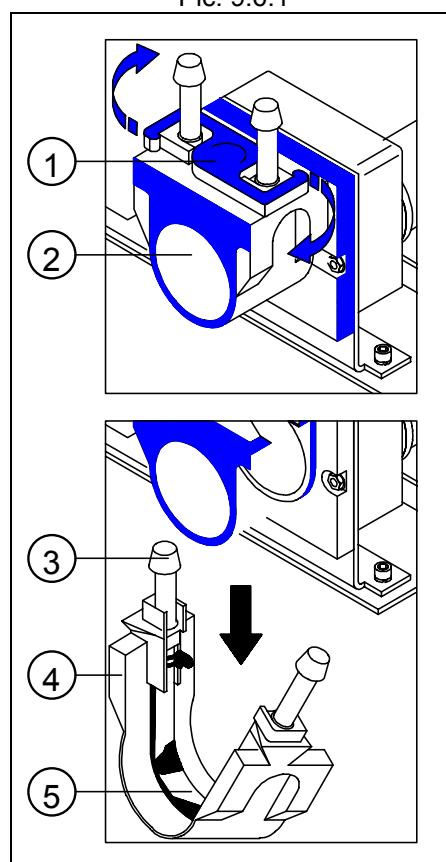
The waste water pump (241050) for the XYZZ-well is a tube pump.
The pump tubing can be replaced as follows:

ATTENTION!
Wear gloves for protection.
Risk of Infection!



1. Switch off instrument.
2. Remove back panel (123268).
3. Turn the seal (1) of the waster water pump (2) to the position “open”.
4. Take the pump hose unit (4) out of the pump (2).
5. Pull the tubing (5) off the pump tubing connections (3).
6. Take the pump tubing (5) out of the sheath (4).
7. Install the new pump tubing (241051). The installation is carried out in the reverse order.

Pic. 9.6.1



ATTENTION!
Ensure correct direction of pumping and suction.
Disregard may lead to malfunction of and cause damage to the
AMAX CS-190!



9.7 Needle XYZZ-Robot

The needle has a fine opening which is necessary for the pipetting sequence. The opening was designed to enable good mixing in the cuvette of the reagent with the sample. Occasionally, it can happen that a reagent crystallises out in the needle. In this case, the needle has to be replaced.

ATTENTION!

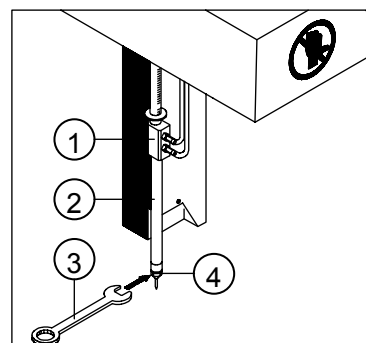
A clogged needle may influence the measuring results.
Wear gloves for protection.
Risk of Infection!



9.7.1 Replacing the Needle

Pic. 9.7.1.1

1. Switch off instrument.
2. Loosen the screw (4) of the needle heating (2) with an open jaw spanner (size 5.5) (3).



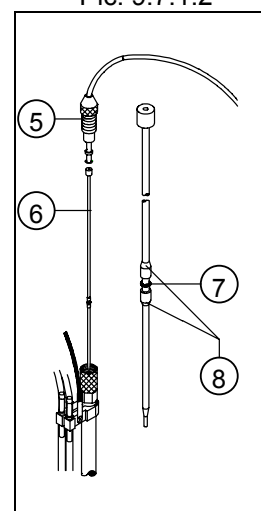
ATTENTION!

Another open jaw spanner (size 7) should be used to grip the needle heating (1) in order to prevent it from being twisted.



3. Unscrew the tubing (5) on the top of the Z-Axis.
Water will flow out of the needle.
4. Push the defective needle (6) out of the heating mantle (1) from below by using the tool (J01818).
Soak up the leaking system fluid with a rag.
A O-ring (7) should still be seated on the needle between both rings (8).
If it isn't, the ring is in the needle heating mantle.
Remove the O-ring from the heating mantle.
Otherwise the system fluid flow through might be inhibited.

Pic. 9.7.1.2



9.7.2 Installing a New Needle

1. Insert the new needle (D10082) (6) carefully into the needle heating mantle (1). Screw the tubing onto the needle.
2. Tighten the screws again.
3. To ensure that the system is air-free, access the user software (main menu), select **“Service”**, then **“Wash”** or **“Prime”**.
4. Check the output jet.

After replacing the needle, the temperature on the needle heating mantle (1) should be checked (finger-test). This test can determine whether or not the flow through of the system fluid is inhibited.

ATTENTION!

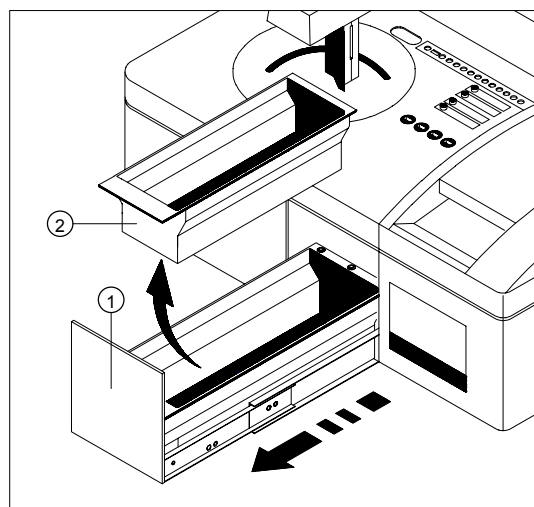
Disregard may lead to malfunction of and cause damage to the AMAX CS-190!



9.8 Cuvette Waste Drawer

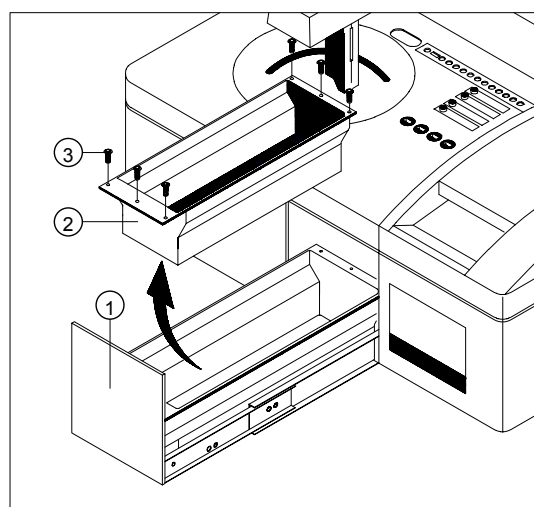
Pic. 9.8.1

- | | | |
|-----------------------------|-----|----------|
| Cuvette waste drawer | (1) | (Q10006) |
| Waste container | (2) | |
| (Bench-top model) | | (122584) |
| (Base cabinet model) | | (122588) |



Pic. 9.8.2

- | | | |
|----------------------|-----|----------|
| Cuvette waste drawer | (1) | (Q10006) |
| Waste container | (2) | (122585) |
| Screws | (3) | (330306) |
| M3x6 ISO 7380 | | |



10. Spare Parts List

Spare Parts List

10 – 1

Artikel <i>Article</i>	BESCHREIBUNG <i>Description</i>	Amelung Nr.	Sigma No
Abdeckung <i>Top</i>	für Inkubationsschiene <i>for incubation rail</i>	113223	T1937
Abwasserschlauch <i>Tubing set waste water</i>	Tank - Gerät <i>Tank - instrument</i>	Q90007	T3187
Adapter <i>Adaptor</i>	für Reagenzring "groß" <i>for reagent ring "large"</i>	113300	A5583
Adapter <i>Adaptor</i>	für Reagenzring "mittel" <i>for reagent ring "medium"</i>	113297	A5708
Adapter <i>Adaptor</i>	für Reagenzring "klein" <i>for reagent ring "small"</i>	113323	A1589
Adapter <i>Adaptor</i>	mit Feder für Cup im Probenring 5ml <i>with spring for cup in plasma stand 5 ml</i>	X10014	A8338
Adapter <i>Adaptor</i>	für Hitachi Cup im Probenring 3ml <i>for Hitachi cup in plasma stand 3 ml</i>	113317	A1839
Adapter <i>Adaptor</i>	für Eppendorf Cup im Probenring 3 ml <i>for Eppendorf cup in plasma stand 3 ml</i>	110619	A1964
Adapter <i>Adaptor</i>	mit Schlitz für Sarstedt Monovette 1,5 ml <i>with slot for Sarstedt monovette 1,5 ml</i>	111869	A0839
Auslegerarm <i>Cantilever arm</i>	XYZZ - Arm komplett <i>XYZZ - arm complete</i>	Q10009	C7466
Barcodeleser <i>Barcode reader</i>	Interner Leser Typ CCD ab AMAX Nr. 3654696 <i>internal reader type CCD since AMAX No. 3654696</i>	240019	S0555
Barcodeleser <i>Barcode reader</i>	Interner Leser Typ CCD incl. Haltewinkel und Software <i>internal reader type CCD incl. holder and software</i>	Q90012	B5798
BD 201 / IRF 540 <i>BD 201 / IRF 540</i>	Transistor für Platine PH-I-HZ <i>Transistor for board PH-I-HZ</i>	216061	A2340

Brunnen <i>Rinse</i>	komplett <i>complete</i>	Q90024	W2374
Bus Kabel <i>Bus cable</i>	8 Bit Bus / 14-polig (Fotometer) <i>8 bit bus / 14 cores (photometer)</i>	273441	
Bus Kabel <i>Bus cable</i>	4 Bit Bus / 10-polig / 1800 mm lang <i>4 bit bus / 10 cores / 1800 mm length</i>	273442	C1965
Bus Kabel <i>Bus cable</i>	4 Bit Bus / 10-polig / 2450 mm lang <i>4 bit bus / 10 cores / 2450 mm length</i>	273443	C3343
Deckelsensor <i>Lid sensor</i>	Sensor für RPB Rad Deckel <i>Sensor for RPB wheel lid</i>	Q90022	A8592
Dichtung 1496 <i>Seal 1496</i>	Teflondichtung für Spritze 500 ul <i>Teflon-seal for syringe 500 ul</i>	350350	S9178
Dilutorkopf <i>Dilutorhead</i>	Ventil für Dilutor <i>Valve for dilutor</i>	240090	M2679
Diskette <i>Disk</i>	PC Programm deutsch <i>PC program German</i>	S06520	F4673
Diskette <i>Disk</i>	PC Programm englisch <i>PC program English</i>	S06521	F4548
Diskette <i>Disk</i>	PC Programm französisch <i>PC program French</i>	S06522	F4423
Diskette <i>Disk</i>	PC Programm holländisch <i>PC program Dutch</i>	S06523	F4298
Diskette <i>Disk</i>	PC Programm italienisch <i>PC program Italian</i>	S06524	F4048
Diskette <i>Disk</i>	Service Programm deutsch / englisch <i>Service program German / English</i>	S06531	F3173
Dosierer <i>Doser</i>	für Dilutor <i>for dilutor</i>	246005	M2179
Durchlauferhitzer <i>Waterflowheater</i>	Temperierung Frischwasser <i>Fresh water warm up</i>	Q10020	W0889

Einstellehre <i>Assembly device</i>	Winkeligkeit Küvettenmagazin <i>Angularity magazine</i>	J01820	A1214
Einstellehre <i>Assembly device</i>	Hubmagnet <i>Solenoid</i>	J01819	
Einstellehre <i>Assembly device</i>	Reihenschieber Ende Lichtschanke <i>Slide pusher end photoelectric barrier</i>	J01827	
Einstellehre <i>Assembly device</i>	Magazin Lichtschanke <i>Magazine photoelectric barrier</i>	J01847	
Enzyclean <i>Enzyclean</i>	Reinigungsflüssigkeit 12 x 15 ml <i>Cleaning agent 12 x 15 ml</i>	110006	A5333
Filtervlies <i>Synthetic fibre web</i>	Staubschutzfilter <i>Dust filter</i>	120396	S9303
Flachriemen <i>Flat belt</i>	Antrieb mechan. Meßstelle <i>for driving mechanical station</i>	120441	F7423
Frischwasserschlauch <i>Tubing set fresh water</i>	Tank - Gerät <i>Tank - instrument</i>	Q90006	T3062
Glasfiberstab <i>Fibre-glass-stick</i>	Versteifung Schlauchsatz <i>Strut for tubing</i>	483050	F7673
IC LM 35 CH <i>IC LM 35 CH</i>	Temp. Sensor für Platine IHZ 2 (Metall) <i>Temp. sensor for board IHZ 2 (metal)</i>	218194	I7530
Inkubationsschiene <i>Incubation rail</i>	komplett <i>complete</i>	Q10005	I7280
Kanister <i>Can</i>	ohne Deckel für Frisch- oder Abwasser <i>without cover for fresh and waste water</i>	627025	A8812
Kanülenheizung <i>Canulae heating</i>	Kanüle incl. Zahnstange <i>Canulae heating incl. toothed rack</i>	D10044	C7716
Kanüle <i>Canulae</i>	Pipettierer (Glaskeramik) <i>Pipetter</i>	D10182	C9071
Kniehebel <i>Toggle lever</i>	für mechan. Meßstelle <i>for mechan. measuring channel</i>	D10074	T0312

Kühlflüssigkeit GF 15 <i>Anti-freezing liquid</i>	für Kühl- u. Warmwasserkreislauf 500 ml <i>for cool and warm water 500 ml</i>	830040	A0589
Küvettenhaltefeder <i>Cuvette holding spring</i>	für mechanisches Meßzentrum <i>for mechanical measuring station</i>	359412	C6591
Küvettenhaltefeder <i>Cuvette holding spring</i>	für optisches Meßzentrum <i>for optical measuring station</i>	120924	C6716
Küvettenmagazin <i>Cuvette storage unit</i>	komplett <i>complete</i>	D10007	C6466
Lampe <i>Lamp</i>	für Photometer <i>for photometer</i>	247410	A3335
Lichtschanke <i>Light barrier</i>	OPB 911 <i>OPB 911</i>	249530	L6036
Lichtschanke <i>Light barrier</i>	OPB 755 <i>OPB 755</i>	249534	L6161
Lichtwellenleiter <i>Fiber optic</i>	5 - armig <i>5 - arm</i>	247427	A5341
Lüfter <i>Fan</i>	Kühlung für Gerät <i>for cooling system</i>	241018	F7422
Meßstelle <i>Measuring channel</i>	Einzelmeßstelle Photometer <i>Single channel for photometer</i>	D10087	M5304
Meßzentrum mech. <i>Mechanical station</i>	mech. Meßzentrum komplett <i>mech. measuring station complete</i>	Q10011	M6054
Meßzentrum optisch <i>Optical station</i>	opt. Meßzentrum komplett <i>opt. measuring station complete</i>	Q10010	O3265
Motor <i>Motor</i>	für Antrieb Reagenzrad komplett <i>for reagent carousel complete</i>	Q90031	M0426
Motor <i>Motor</i>	für Y-Antrieb komplett <i>for Y-drive complete</i>	Q90025	M0676
Motor <i>Motor</i>	für X-Antrieb komplett <i>for X-drive complete</i>	Q90026	M0551

Motor <i>Motor</i>	Z-Antrieb incl. Motorhalter u. Kupplung <i>Z drive complete incl. holder</i>	Q90016	M5929
Motor <i>Motor</i>	Antrieb mech. Meßstelle <i>Driving mech. measuring station</i>	Q90019	M6679
MTP 8P10 <i>MTP 8P10</i>	Transistor für Platine PH - R2R <i>Transistor for board PH - R2R</i>	216060	M6929
Netzteil I (untere NT) <i>Power supply I</i>	Netzteilmodul für + 5, + 24, - 24 Volt <i>Power supply for + 5, + 24, - 24 volts</i>	245520	P1596
Netzteil II <i>Power supply II</i>	Netzteilmodul für + 12, + 15, + 24 Volt <i>Power supply for + 12, + 15, + 24 volts</i>	245525	P1721
One Chip CPU <i>One chip CPU</i>	„Magazin“ <i>„Magazin“</i>	S60900	E1648
One Chip CPU <i>One chip CPU</i>	„Kugelmeßz.“ <i>„Kugelmeßz.“</i>	S61100	
One Chip CPU <i>One chip CPU</i>	„Klappmech.“ (für alte Feder bis AMAX CS-190 Nr.97Q50560) <i>„Klappmech.“ (for old spring to AMAX CS-190 No. 97Q50560)</i>	S60700	
One Chip CPU <i>One chip CPU</i>	„Klappmech.“ (für neue Feder ab AMAX CS-190 Nr. 97Q50561) <i>„Klappmech.“ (for new spring after AMAX CS-190 No. 97Q50561)</i>	S60701	
One Chip CPU <i>One chip CPU</i>	"RPB - Rad" <i>"RPB - Rad"</i>	S06210	O4140
One Chip CPU <i>One chip CPU</i>	"Wasser" <i>"Wasser"</i>	S06211	O4265
One Chip CPU <i>One chip CPU</i>	"XYZZ - Robot" <i>"XYZZ - Robot"</i>	S06212	O4390
One Chip CPU <i>One chip CPU</i>	"Dilutor" <i>"Dilutor"</i>	S06213	O4515
One Chip CPU <i>One chip CPU</i>	Firmware Cavro Dosierer <i>Firmware Cavro Doser</i>	S06233	A8092

One Chip CPU <i>One chip CPU</i>	"Foto Ladeprg." <i>"Foto Ladeprg."</i>	S61500	O2515
One Chip CPU <i>One chip CPU</i>	"AD - Wandler" <i>"AD - Wandler"</i>	S06215	O1015
O-Ring 720396 <i>O-ring 720396</i>	Dichtung für Spritze 500 ul <i>Seal for syringe 500 ul</i>	350121	SO3015
O-Ring 3 x 1 <i>O-ring 3 x 1</i>	Dichtung für Dilutor-Ventil <i>Seal for dilutor-valve</i>	350001	O3140
O-Ring 14 x 2,5 <i>O-Ring 14 x 2,5</i>	Dichtung für separaten Wassereinfülltank (100 Stck) <i>Seal for separate watertank (100 pcs.)</i>	350109	P1887
Peltierelement <i>Peltier element</i>	Kühlung Plasma-Reagenzrad <i>Cooling plasma-reagent-tray</i>	266010	P1096
Plasmateller <i>Plasma stand</i>	Aufnahme Plasmen <i>for accommodating plasmas</i>	Q90001	A9083
Plasmateller 3 ml <i>Plasma stand 3 ml</i>	für 3 ml Röhrchen <i>for 3 ml tubes</i>	Q90003	A1458
Plasmateller <i>Plasma stand</i>	universal <i>universal</i>	Q90023	
Platine S-HY <i>PC board S-HY</i>	SE Auswertung <i>SE evaluation</i>	Q90015	P1971
Platine PH-MCK <i>PC board PH-MCK</i>	Bus Adapter <i>Bus adaptor</i>	D00801	P2096
Platine PH-MCK2 <i>PC board PH-MCK2</i>	Bus Adapter <i>Bus adaptor</i>	D03601	P2221
Platine PH-K1 <i>PC board PH-K1</i>	Magazinsteuernung <i>Repository control</i>	D03001	P2346
Platine PH-K2 <i>PC board PH-K2</i>	Magazinsteuernung <i>Repository control</i>	D03101	P2471
Platine PH-K3 <i>PC board PH-K3</i>	Magazinsteuernung <i>Repository control</i>	D03201	P2596

Platine PH-K4 <i>PC board PH-K4</i>	Magazinststeuerung <i>Repository control</i>	D03301	P2721
Platine PH-K5 <i>PC board PH-K5</i>	Magazinststeuerung <i>Repository control</i>	D03401	P2846
Platine ADAP15 <i>PC board ADAP15</i>	Magazinststeuerung <i>Repository control</i>	D04101	P2971
Platine PH-K-A1 <i>PC board PH-K-A1</i>	Magazinststeuerung <i>Repository control</i>	D04001	P3096
Platine PH-XYZZ <i>PC board PH-XYZZ</i>	Robotsteuerung <i>Robot control</i>	D00101	P3221
Platine PH-RC <i>PC board PH-RC</i>	Filterplatine <i>Filter board</i>	D01401	P3346
Platine PH-AD-346 <i>PC board PH-AD-346</i>	Adapterkarte X <i>Adaptor board X</i>	D01801	P3471
Platine PH-X-ADA2 <i>PC board PH-X-ADA2</i>	Adapterkarte Y incl. Motor-Entstörung <i>Adaptor board Y incl. motor-interference suppr</i>	D01302	
Platine PH-F <i>PC board PH-F</i>	Sicherungskarte Photometer <i>Photometer fuse board</i>	D05901	P3721
Platine AM-F2 <i>PC board AM-F2</i>	Sicherungskarte Stromversorgung <i>Main fuse board</i>	D07101	P3846
Platine AM-DIL <i>PC board AM-DIL</i>	Dilutorsteuerung <i>Dilutor control</i>	D05701	P3971
Platine AM-RPB <i>PC board AM-RPB</i>	Steuerung Reagenz-Plasmarad <i>Control reagent-plasma-carousel</i>	D00301	P4096
Platine PH-TU <i>PC board PH-TU</i>	Temperatur Messung (ohne LM 35) <i>temperature measurement (without LM 35)</i>	D02601	P4346
Platine PH-LSX <i>PC board PH-LSX</i>	Level Sensorik <i>Level sensory electronics</i>	D01702	P4471

Platine AM-I-HZ <i>PC board AM-I-HZ</i>	Heizung Inkubationsschiene (ohne IRF 540) <i>Heating incubation-rail (without IRF 540)</i>	D07401	P4596
Platine PH-IHZ2 <i>PC board PH-IHZ2</i>	Heizungsplatine Kanülenheizung und Durchlauferhitzer <i>Heating board for canulae-heating and waterflow heater</i>	D01101	P4721
Platine PH-O-RA <i>PC board PH-O-RA</i>	RK Adapter <i>RK adaptor</i>	D06401	P4846
Platine PH-O-RK <i>PC board PH-O-RK</i>	Rechnerkarte Photometer <i>Computer card photometer</i>	D02501	P4971
Platine PH-R 2 R <i>PC board PH-R 2 R</i>	Steuerung Peltier Elemente (ohne MTP8P10) <i>Control for peltier elements (without MTP8P10)</i>	D06101	P5221
Platine PH-M-MB <i>PC board PH-M-MB</i>	Steuerung mech. Meßstelle <i>Control for mech. measuring station</i>	D05601	P5346
Platine PH-AD-16B <i>PC board PH-AD-16B</i>	AD Wandler <i>AD transducer</i>	D07001	P5471
Platine PH-BUE <i>PC board PH-BUE</i>	Anschluß Board zum PC <i>connecting to PC</i>	D02701	P5596
Platine AM-M-HT <i>PC board AM-M-HT</i>	Heizung mech. Meßstelle <i>Heating mech. measuring channel</i>	D06301	P5721
Platine AM-M-SH <i>PC board AM-M-SH</i>	Steuerung mech. Meßstelle <i>Control mech. measuring channel</i>	D06901	P5846
Platine PH-HALL <i>PC board PH-HALL</i>	Steuerung Magnetgeber <i>Control hall switch</i>	D05201	P5470
Platine PH-H 2 O <i>PC board PH-H 2 O</i>	Steuerung Wasserkreislauf <i>Control water circulation</i>	D00901	P6096
Platine PH-O-HZ <i>PC board PH-O-HZ</i>	Heizung opt. Meßzentrum <i>Heating opt. measuring center</i>	D06501	P4720

Lichtstromregelung kompl. <i>light current regulator complete</i>	Photometer Version 1 <i>Photometer version 1</i>	Q10015	P5220
Lichtstromregelung kompl. <i>photocurrent regulator complete</i>	Photometer Version 2 <i>Photometer version 2</i>	Q10115	P5345
Platine <i>PC board</i>	Mutterbord - Photometer Version 1 <i>Motherboard photometer Version 2</i>	D04701 D08201	P6596
Platine <i>PC board</i>	Analogfilter Photometer (Meßverstärker) bis 8/95 Version 1 <i>Analoge filter photometer (measuring amp.) until 8/95 version 1</i>	D04401	P4845
Platine AM-O-MV <i>PC board AM-O-MV</i>	Analogfilter Photometer (Meßverstärker) ab 8/95 Version 2 <i>Analoge filter photometer (measuring amp.) since 8/95 version 2</i>	D08101	P4970
Platine <i>PC board</i>	Referenzkanal Photometer Version 1 <i>Analoge filter ref. photometer version 1</i>	D04801	P7096
Platine <i>PC board</i>	Netzteil Photometer-Verstärker Version 1 <i>regulator photometer version 2</i>	D04501 D08301	P7221
Platine PH-PC <i>PC board PH-PC</i>	Interface für PC <i>Interface for PC</i>	D02801	P7346
Pneumatic-Schlauch <i>Pneumatic-tubing</i>	Maß 6 x 4 per 1000 mm <i>Dim. 6 x 4 per 1000 mm</i>	239020	P0721
PU-Schlauch <i>PU-tubing</i>	Maß 2 x 0,5 x 3 schwarz per 1000mm <i>Dim. 2 x 0,5 x 3 black per 1000 mm</i>	239260	P0971
PVC-Schlauch <i>PVC-tubing</i>	Maß 9 x 1.5 per 1000 mm <i>Dim. 9 x 1.5 per 1000 mm</i>	239290	P0846
Reagenzrad <i>Reagent carousel</i>	komplett <i>complete</i>	Q10004	R7524

Reagenzteller <i>Reagent stand</i>	Aufnahme Reagenzien <i>for accommodating reagents</i>	Q90002	A1583
Referenzkanal <i>Reference channel</i>	für Photometer Version 2 <i>for photometer version 2</i>	D10088	C3717
RPB Rad Sensor <i>RPB wheel sensor</i>	Ersatzteil Kit komplett <i>Spare part kit complete</i>	Q90032	
Rührer <i>Stirrer</i>	für Reagenz <i>for reagent</i>	242220	S9553
Rührer <i>Stirrer</i>	Magnetrührer für Inkubations-Schiene <i>for incubation rail</i>	D10071	S9678
Schieber 2 <i>Slide 2</i>	Schieber zum Öffnen der opt. Meßstelle <i>Slide for opening opt. channel</i>	113282	S9428
Schlauch <i>Waste pump tube</i>	Ersatzschlauch für Abwasserpumpe <i>Sparepart for waste pump</i>	241051	W1014
Schlauchpumpe <i>Peristaltic pump</i>	für Abwasser <i>for effluent</i>	241050	P1221
Schlauchsatz <i>Tubing set</i>	Dilutor-Kanüle (zur Z-Achse) <i>Dilutor-canulae (to z-axis)</i>	Q10062	A1958
Schlauchsatz <i>Tubing set</i>	Kanülenheizung (zur Z-Achse) mit Glasfaserstab <i>canulae heating to z-axis without fibre-glass-stick</i>	Q10063	T1812
Schwingkolbenpumpe <i>Oscillating piston pump</i>	für Dilutor-Vorlauf <i>for dilutor</i>	241088	O3390
Schwingkolbenpumpe <i>Oscillating piston pump</i>	für Kühlwasserkreislauf <i>for coolant water circulation</i>	241087	O2640
Platine AM-S-HY + Sensor <i>Platine and AM-S-HY + sensor</i>	komplett geprüft <i>compl. proofed</i>	Q90015	S8428
Silicon-Schlauch <i>Silicon-tubing</i>	Maß D 5.5 / d 2 per 1000 mm <i>Dim. D 5.5 / d 2 per 1000 mm</i>	239040	S0179

Silicon-Schlauch <i>Silicon-tubing</i>	Maß D 6 / d 3 <i>Dim. D 6 / d 3</i>	per 1000 mm <i>per 1000 mm</i>	239080	S0304
Silicon-Schlauch <i>Silicon-tubing</i>	Maß D 8 / d 4 <i>dim. D 8 / d 4</i>	per 1000 mm <i>per 1000 mm</i>	239670	S0429
Spritze 500 ul <i>Syringe 500 ul</i>	für Dilutor <i>for dilutor</i>		290007	A1833
Tragegriff <i>Carrying handle</i>	Transportgriffe zum Tragen (1 Stk.) <i>Handle for transporting</i>		110626	C7091
Tygon-Schlauch <i>Tygon-tubing</i>	Maß D 1.14 / d 0.84 <i>Dim. D 1.14 / d 0.84</i>	per 1000 mm <i>per 1000 mm</i>	239001	T1312
Wasserbehälter II <i>Watertank II</i>	Temperierung Warmwasserkreislauf <i>Water warm up</i>		D10068	W0389
Wasserfilter <i>Water filter</i>	Filter für Kühlwasserkreislauf <i>Coolant water circulation</i>		241071	W0514
Zahnriemen <i>Toothed driving belt</i>	Antrieb für Dilutor <i>Drive for dilutor</i>		120505	
Zahnriemen <i>Toothed driving belt</i>	X-Antrieb (lang) <i>X-drive (long)</i>		120449	T2062
Zahnriemen <i>Toothed driving belt</i>	Y-Antrieb (lang) <i>Y-drive (long)</i>		120451	T1187
Zahnriemen <i>Toothed driving belt</i>	X-Antrieb (kurz) <i>X-drive (short)</i>		120448	T2312
Zahnriemen <i>Toothed driving belt</i>	Y-Antrieb (kurz) <i>Y-drive (short)</i>		120453	T1062
Zahnriemen <i>Toothed driving belt</i>	Antrieb für RPB-Rad <i>Drive for RPB-wheel</i>		120461	
Zahnriemen <i>Toothed driving belt</i>	Antrieb für RPB-Rad <i>Drive for RPB-wheel</i>		120462	

11. Service Software

	Description	11 – 1
11.1	Dilutor	11 – 6
11.2	Mechanical Measuring Unit	11 – 11
11.3	Cuvette Magazine	11 – 15
11.4	Reagent-Plasma-Tray	11 – 19
11.5	Photometer	11 – 23
11.6	XYZZ-Robot	11 – 33
11.7	Liquid Management	11 – 38
11.8	Text Viewer	11 – 41
11.9	Service Logbook	11 – 42
11.10	AMAX Teach in Program	11 – 43
11.10.1	Adjustable XY-Positions	11 – 47
11.10.2	Adjustable Z-Positions	11 – 49
11.11	Barcode Setup	11 – 51
11.12	AMAX Continuous Test Program	11 – 52
11.13	AMAX Continuous Test II	11 – 53
11.14	AMAX Self Test Program	11 – 54
11.15	Error Codes	11 – 55
11.16	AD Converter	11 – 55
11.17	Photometer Auto Align	11 – 56
11.18	Drip Test	11 – 57

In addition to the user software, the service software has been installed on the commander PC ⇒ **Service program**.

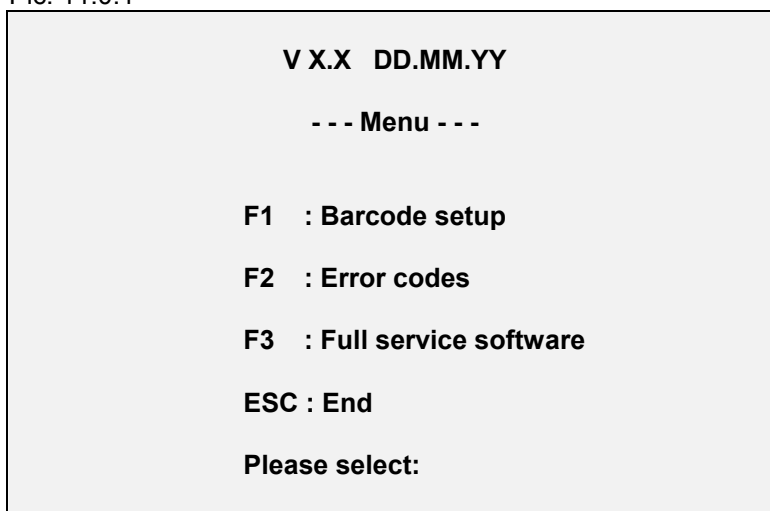
The AMAX CS-190 has to be operational: The instrument has to be turned on and connected to the commander PC.



7.5

In order to access the service software, exit the user software.
The screen should say **C:\AMAX**. Access the menu screen by pressing **<S>**.

Pic. 11.0.1



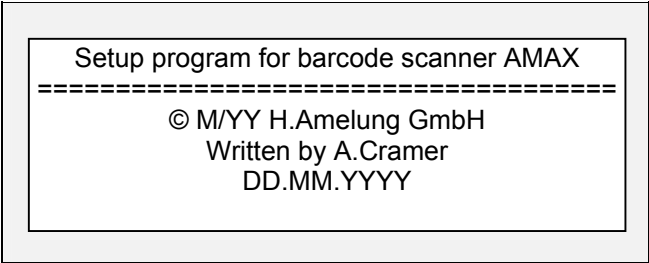
Choose the desired program from the menu by using the function keys:

- <F1> : Barcode setup**
Adjusts the barcode reader of the reagent-plasma-tray. (Older version, has become obsolete in combination with the new barcode reader).
- <F2> : Error codes**
Error codes, which appeared on the screen as part of an error message of a module, can be entered here. The deciphering of the entered code appears on the screen.
- <F3> : Full service software**
Starts the full **service program**.
- <ESC> : End**
Exits the program and the screen displays: **C:\AMAX**.

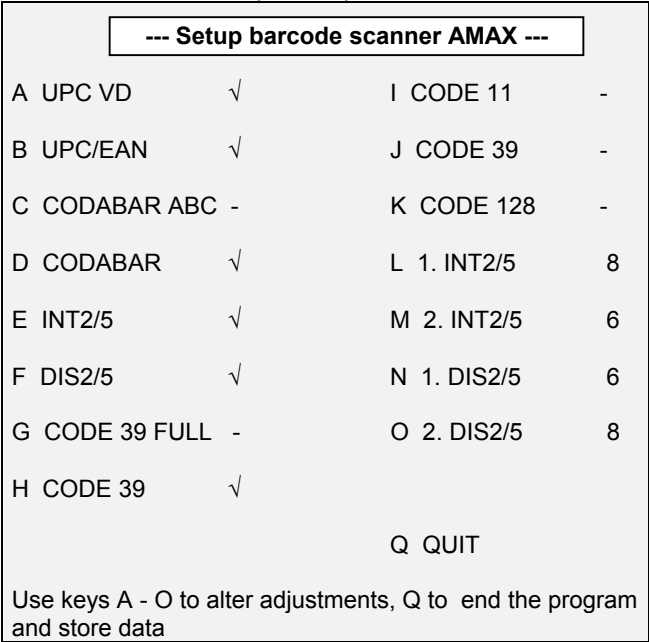
<F1>: Barcode setup

<F1> opens the window barcode setup AMAX CS-190 (Pic. 11.0.2)

Pic. 11.0.2



Pic. 11.0.3 Setup example



<A> - <O> : Each barcode can be selected (on or off).

<Q> : Exits the program and stores the setup.

The screen displays:

- - - AMAX service program main menu - - -

IMPORTANT!

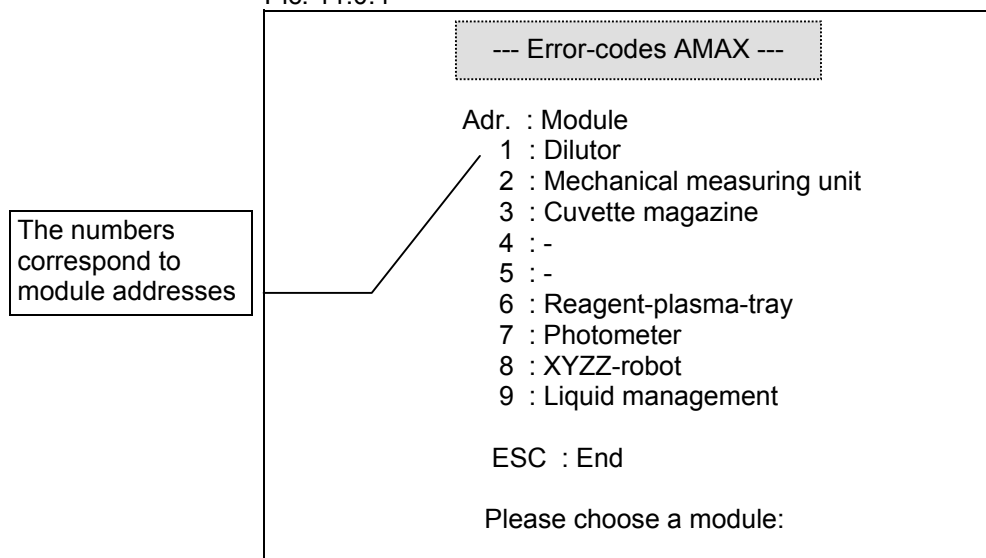
The barcode setup program was created only for a particular barcode scanner generation. Should the program not be accessible, the installed scanner does not need to be adjusted.



<F2>: Error codes

<F2> opens the window "Error codes AMAX" (Pic. 11.0.4)

Pic. 11.0.4



When selecting a module, you will be asked whether you want to decipher an error code or if you want to inquire an error via the AML-Bus.

- After entering an error code, the error code description is displayed on the screen.
- When making a query using the AML-bus, the description appears on the screen after the corresponding module has been scanned.

<ESC> exits the program. The screen displays:

- - - **AMAX service program main menu** - - -

<F3>: Full service software

When the **full service software** is accessed by <F3>, a password protection window appears (Pic. 11.0.5). Here you have to enter the password. It protects the service program from **unauthorised** access.

ATTENTION!

Disregard may lead to malfunction of the AMAX CS-190!



Enter the password here to start the **service program**.

The password is: LIPPE (lippe)

When the password has been entered correctly, the **main menu** (Pic. 11.0.6) of the **service software** appears.

Pic. 11.0.5

By using the function keys <F1> - <F10> / <ALT+F1> - <ALT+F10>, each service program is started.

Pic. 11.0.6

```

--- AMAX service program main menu ---

F1      : XYZZ-robot          ALT F1 : Error codes
F2      : Dilutor            ALT F2 : 16-Bit AD-converter
F3      : Cuvette magazine   ALT F3 : AMAX continuous test program
F4      : Reagent-plasma-tray ALT F4 : AML-BUS 4-Bit
F5      : Liquid management  ALT F5 : AML-BUS 8-Bit
F6      : Photometer         ALT F6 : Service logbook
F7      : Mechanical measuring unit ALT F7 : Text viewer
F8      : AMAX teach program  ALT F8 : AMAX continuous test II program
F9      : AMAX self test program ALT F9 : Drip test
F10     : Barcode setup       ALT F10: Photometer auto align

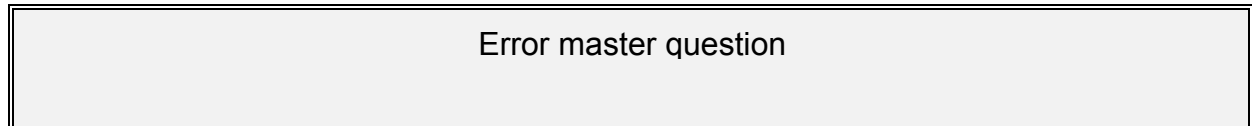
ESC     : End

Please select :
```

Appearance of a message in the service program

In the running service program, a message from a module can appear on the screen. This message appears in a pink box (see Pic. 11.0.7) with the designation: Error master question.

Pic. 11.0.7



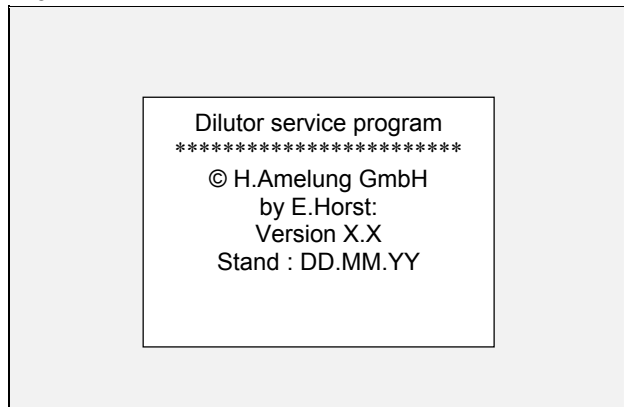
Check, if this message indicates an impairment of the module's performance. If it doesn't, the message can be ignored.



11.1 Dilutor

<F2> selects the window "Dilutor service program" (Pic. 11.1.1)

Pic. 11.1.1



<F1> Selects the associated program parts.
-
<F10> :

Pic. 11.1.2

Dilutor service program	
Address : 1 4-Bit	
F1	: Module report
F2	: Master question
F3	: Bus test
F4	: Dilutor
F5	: Free input
F6	: Washing pump
F7	: Tubing pump
F8	: Mixer
F9	:
F10	: Reset

In the following sections, the display of each program part is described individually:

<F1> : This module report is displayed.

Pic. 11.1.3

Module reports :	
A M A X DOSIERER V X.X.	E.HORST
Short report DOS V XX DD.MM.YYYY	

<F2> : The master question is queried here. The answer is displayed on the screen.
Pic.11.1.4 shows an example.

Pic. 11.1.4

Answer master question : 8	
0	B7 Last command is executed
0	B6 Parameter out of limits
0	B5 Wrong command code
0	B4 Parameter number wrong
1	B3 Dilutor command is executed
0	B2 Dilutor error
0	B1 Water shortage
0	B0

<F3> : Starts the AML-BUS test.
The communication between the photometer and the commander PC is checked. Should a problem occur (interruption), it can be determined here.
⇒ **Error message**

Pic. 11.1.5

How often shall the test be repeated ? X
Number of tests executed :
Number of error runs : X means X.X%

<F4> : Selects a sub-program for the dilutor. Each sub-program can be selected here.

Pic. 11.1.6

Dilutor service program	
Address : 1 4-Bit	
1	: Dilutor test commands
2	: Dilutor query
3	: Dilutor commands
4	: Dilutor baud rate
5	: Dilutor address
6	: Dilutor status
End = ESC	

- <1>** : Sub-program
"Dilutor test commands"
- <1>** ,
<2> : The output of the dilutor is initialised. The user can decide if the output of the valve should be on the right or left side.
- <3>** ,
<4> ,
<5> : The individual valve positions can be selected.
- <6>** : The plunger moves to position 1.
- <7>** : The plunger moves to position 2.
- <8>** : The speed of the plunger is increased.
- <9>** : The speed of the plunger is decreased.

- <T>** : The dilutor carries out a test routine with different speeds.
- <ESC>** : Exits the sub-program "Dilutor test commands".

Pic. 11.1.7

Dilutor service program	
Address : 1 4-Bit	
1	: Initialises right output
2	: Initialises left output
3	: Valve input
4	: Valve output
5	: Valve bypass
6	: Move to position 1
7	: Move to position 2
8	: Set speed fast
9	: Set speed slow
T	: Test program
ESC	: End

- <2>** : Sub-program:
Dilutor query
- Data from the dilutor is queried and displayed here.

Pic. 11.1.8

Dilutor service program	
Address : 1 4-Bit	
Plunger position	= X
Start velocity	= XXX
Top velocity	= XXXX
Stop velocity	= XXX
Lost valve steps	= X
Number of valve movements	= XX
Supply voltage	= XX
Firmware	= XL-3000 M YYYY P/N XXX
End	= ESC

<3> : Sub-program
"Dilutor commands"

<1>

-

 : Dilutor parameters can be altered.

This is irrelevant for service use.

<ESC> : Exits the sub-program
"Dilutor commands".

Pic. 11.1.9

Dilutor service program	
Address : 1 4-Bit	
1	: Set speed
2	: Set absolute position
3	: Set relative aspiration
4	: Set relative dispense
5	: Set top velocity
6	: Set start velocity
7	: Set cutoff steps
8	: Set cutoff velocity
9	: Set slope
B	: Set backlash
End = ESC	

<4> : Sub-program
"Dilutor baud rate"
The baud rate can be adjusted.

This is irrelevant for service use.

Pic. 11.1.10

Baud rate 1200 - 19000 ?

<5> : Sub-program
"Dilutor address"
The dilutor address can be altered.

This is irrelevant for service use.

Pic. 11.1.11

Dilutor address 1-F

<6> : Sub-program
"Dilutor status"
The dilutor status can be queried here.

Pic. 11.1.12

Dilutor status : No error
End = ESC

<ESC> : Exits the sub-program "Dilutor".

<F5> : A command can be entered in hexadecimal format.

Pic. 11.1.13

Order to transmit (in Hex) :

This is irrelevant for service use.

<F6> : Sub-program "Rinse pump"

Pic. 11.1.14

<1>

-

<5> : The rinse pump can be accessed.

<6> : A water deficiency can be simulated.

<7> : The water levels can be queried.

<8> ,

<9> : The automatic venting can be enabled or disabled.

<ESC> : Exits the sub-program "Rinse pump".

Dilutor service program
Address : 1 4-Bit

- 1 : Pump on with frequency
- 2 : Set frequency
- 3 : Pump on
- 4 : Pump off
- 5 : Pump on for defined time
- 6 : Set water deficiency
- 7 : Query water levels
- 8 : Automatic venting to disable
- 9 : Automatic venting to enable
- End = ESC

<F7> ,

<F8> : These sub-programs are not needed (no function).

They are irrelevant for service use.

<F10> : The dilutor is reset. All parameters are restored to their original values.

<ESC> : Exits the dilutor service program. The screen displays:

- - - **AMAX service program main menu** - - -

11.2 Mechanical Measuring Unit

<F7> opens the window "Mechanical Measuring Unit Service Program" (Pic. 11.2.1)

Pic. 11.2.1

```

*****
*
*
*   MECHANICAL MEASURING UNIT SERVICE PROGRAM   *
*   =====                                     *
*
*
*   © MM/YY Heinrich Amelung GmbH                 *
*
*   Written by A.Cramer                           *
*
*   Machine : AMAX                               *
*
*   Carry on with any key                         *
*****

```

Pic 11.2.2 shows a window with each executable command.

Pic. 11.2.2

Service program mechanical measuring unit AMAX									
O.....Open and close measuring channel									
1 - 4...measuring channel 1 - 4 start and stop	<table border="1"> <tr><td>Incub.MZ1:</td><td>stop</td></tr> <tr><td>Incub.MZ2:</td><td>stop</td></tr> <tr><td>Incub.MZ3:</td><td>stop</td></tr> <tr><td>Incub.MZ4:</td><td>stop</td></tr> </table>	Incub.MZ1:	stop	Incub.MZ2:	stop	Incub.MZ3:	stop	Incub.MZ4:	stop
Incub.MZ1:	stop								
Incub.MZ2:	stop								
Incub.MZ3:	stop								
Incub.MZ4:	stop								
I.....Start incubation time									
M.....Display module report									
B.....Test AML-BUS connection									
R.....Execute software reset	<table border="1"> <tr><td>Measure MZ1:</td><td>stop</td></tr> <tr><td>Measure MZ2:</td><td>stop</td></tr> <tr><td>Measure MZ3:</td><td>stop</td></tr> <tr><td>Measure MZ4:</td><td>stop</td></tr> </table>	Measure MZ1:	stop	Measure MZ2:	stop	Measure MZ3:	stop	Measure MZ4:	stop
Measure MZ1:	stop								
Measure MZ2:	stop								
Measure MZ3:	stop								
Measure MZ4:	stop								
T.....Measure and show temperature									
V.....Change parameter									
Z.....Display current measuring channel status									
E.....Exit program									
Please choose :									

Execute commands by using the keys <O> - <Z>.

<O> : Any measuring cell (knee joint) can be opened or closed.

Pic. 11.2.3

Open and close measuring channels for cuvette waste disposal:
=====

1...4 Measuring channel 1-4 open and close
Only one measuring channel can be opened at the same time!

Abort with ESC

<1> Any measuring cell (no. 1-4) can be activated or deactivated.
-
<4> : **A real measurement is not possible with this part of the program.**

Pic. 11.2.4

Start the measuring channel with the number X :
=====

Measurement timeout is:	205 s
Interval start time is:	77 s
Starting value pause time is:	1 x 0,1 s

Start with the connected pipette or with <P> !
Abort with ESC !

<I> : Starts the incubation time any measuring cell.

Pic. 11.2.5

Start incubation time :
=====

120 seconds will be incubated !

Measuring channel number in which to incubate ? (1-6) :

<M> : Displays a module report.

Pic. 11.2.6

Module reports are :
=====

AMAX MECHMESS PROTOTYP A:CRAMER

Module short report is:

Module: KMM Version: X Datum: DD.MM.YYYY

Carry on with any key

**** : Starts the AML-BUS test.
The communication between the mechanical measuring unit and the commander PC is checked.

Pic. 11.2.7

Test AML-Bus connection :
=====

Abort with ESC

Number of test runs : 5

Should a problem (interruption) occur, it can be determined here.
⇒ **Error message**

<R> : The measuring cell carries out a reset.
All parameters are reset to their old values.

Pic. 11.2.8

Send software reset to the mechanical measuring channel:
=====
Please wait ...
Number of measuring channels is 4
ATTENTION : All parameters are back to their starting values !
Carry on with any key

<T> : The temperature of the measuring unit is measured and displayed.

Pic. 11.2.9

Measure and show temperature ALU-block :
=====
Abort with ESC
Temperature ALU-Block is : 38°C

<V> : Alters the setup of the measuring cell.

This is irrelevant for service use.

Pic. 11.2.10

Adjust parameters of the measuring channels :	
=====	
Enter measuring channels start-up time (x 100ms)	:X.Xs
Interval mode starting time measuring channel 1 (in s)	:X.Xs
Start time is	:X.Xs
Enter measuring channels start-up time (x 100ms)	:X.Xs
Interval mode starting time measuring channel 2 (in s)	:X.Xs
Start time is	:X.Xs
Enter measuring channels start-up time (x 100ms)	:X.Xs
Interval mode starting time measuring channel 3 (in s)	:X.Xs
Start time is	:X.Xs
Enter measuring channels start-up time (x 100ms)	:X.Xs
Interval mode starting time measuring channel 4 (in s)	:X.Xs
Start time is	:X.Xs
Int. mode starting value pause time measuring channel 1 (in s)	:X.Xs
Int. mode starting value pause time measuring channel 2 (in s)	:X.Xs
Int. mode starting value pause time measuring channel 3 (in s)	:X.Xs
Int. mode starting value pause time measuring channel 4 (in s)	:X.Xs
Enter measurement timeout (in s)	:X.Xs
Timeout	:X.Xs
Enter incubation time (in s)	:X.Xs
Enter delay time Start ⇒ Rotate (x 0.1s)	:X.Xs
Carry on with any key	

<Z> : Shows the current status of the measuring cells.

This is irrelevant for service use.

Pic. 11.2.11

Display current measuring channel status: =====						
Abort with ESC !						
	Timer	Sens.	Res.	Int1	Int2	Int3
Channel 1	low	low	low	low	low	low
Channel 2	low	low	low	low	low	low
Channel 3	low	low	low	low	low	low
Channel 4	low	low	low	low	low	low

<E> : Exits the mechanical measuring unit service program. The screen displays:

- - - AMAX service program main menu - - -

11.3 Cuvette Magazine

<F3> opens the window “Cuvette Magazine Service Program” (Pic. 11.3.1):

Pic. 11.3.1

```

*****
*
*
*      CUVETTE MAGAZINE SERVICE PROGRAM
*      =====
*
*
*      © MM/YY Heinrich Amelung GmbH
*
*      Written by A.Cramer
*
*      Machine : AMAX
*
*      Carry on with any key
*****

```

<j> : Resets the cuvette magazine
(has to be carried out after any
reboot of the AMAX CS-190)

Pic. 11.3.2

Execute software reset routine (y/n) ?

Picture 11.3.3 shows each of the window's executable commands.

Pic. 11.3.3

Press keys <I> - <E>.

```

Service program cuvette magazine AMAX

Program menu :
=====

I ...Single commands incubation rail
M...Display module command
B...Test AML-Bus connection
R...Execute software reset
L...Display light barriers
F...Execute test routine
S...Single commands row pusher
K...Single commands cuvette comb
T...Single commands conveyor and lifting solenoids
P...Adjust speeds and run times
E...End program

Please choose:

```

<I> : The commands of the incubation rail (Q10005) can be accessed here.

Press keys <1> - <9>.

Function check of the lifting solenoid and the light barrier setup.

<ESC> exits this sub-program.

Pic. 11.3.4

```

Edit single commands incubation rail :
=====

Abort with ESC !

1...Cuvette pusher to the top
2...Cuvette pusher to the bottom
3...Mixer start
4...Mixer stop
5...Lifting magnet incubation rail on
6...Lifting magnet incubation rail off
9...Continuous test lifting solenoid

Please choose :
```

<M> : Displays the module report.

Pic. 11.3.5

```

The module reports are :
=====

AMAX  MAGAZIN  PROTOTYP A:CRAMER

Module short report is :

Module: KMA Version: X Datum: DD.MM.YYYY

Carry on with any key
```

**** : Starts the AML-BUS test. The communication between the cuvette magazine and the commander PC is checked. Should a problem occur (interruption), it can be determined here.

⇒ **Error message**

Pic. 11.3.6

```

Test AML-Bus connection :
=====

Abort with ESC !

Test runs : 5
```

<R> : The cuvette magazine carries out a reset. All parameters are restored to their original values.

Pic. 11.3.7

```

Transmit soft reset to the cuvette magazine :
=====

Please wait .....

Carry on with any key
```

<L> : The status of the cuvette magazine light barriers are displayed. A functionality check is possible by manually moving the pusher/switch. The reflection light barriers are checked by blocking them with a cuvette box.

Pic. 11.3.8

```
Show light barrier status :
=====
Abort with ESC !

Cuvette pusher at the bottom           : low
Cuvette pusher at the top              : high
Row pusher at the end                  : high
Row pusher at beginning                : high
Row pusher at tension point            : high
Cuvette comb at tension point          : high
Cuvette comb is moved up               : high
Cuvette comb is moved down             : low
Cuvette comb is moved to the front     : high
Cuvette comb is moved to the back      : high
Reflex light barrier is in front        : low
Reflex light barrier magazine blockage waste disposal : high
Reflex light barrier magazine supply   : low
```

<F> : The cuvette magazine carries out a test routine. All components are included.

Pic. 11.3.9

```
Execute test routine :
=====
Abort with ESC !

Move cuvette into the XYZZ-robot

Test - Cycle No.: X
```

IMPORTANT!

This command may be executed only when the cuvette magazine has been disassembled. When still installed, the cuvettes can't be processed by the XYZZ-robot, because the robot cannot be addressed with this program.



<S> : The row pusher can be put under tension or moved to its original position.

Press keys <1>, <2>.

Pic. 11.3.10

```
Edit single commands row pusher :
=====
Abort with ESC !

1...Tighten row pusher
2...Drive back row pusher
```

<K> : The cuvette comb can be moved to different positions.

Press keys <1> - <4>

Pic. 11.3.11

```
Edit single commands cuvette comb :
=====
Abort with ESC !

1...Tighten cuvette comb
2...Move cuvette comb back
3...Move cuvette comb to the top
4...Move cuvette comb to the bottom
```

<T> : The conveyors for the cuvette boxes can be activated or deactivated. The lifting solenoids in the cuvette box storage area can be retracted.
Press keys <1> - <5>

Pic. 11.3.12

Edit single commands conveyor and lifting solenoids:
 =====

Abort with ESC !

- 1...Start supply conveyor
- 2...Stop supply conveyor
- 3...Waste disposal band on for defined run time
- 4...Lifting solenoids on
- 5...Lifting solenoids off

IMPORTANT!

Never leave the conveyors and the lifting solenoids turned on for longer than 30sec.



<P> : The speed and the running times of the individual stepper motors can be adjusted. Default values are displayed in brackets.

Pic. 11.3.13

Adjust speeds of the stepper motors and run times:
 =====

- | | |
|---|---|
| Enter cuvette pusher speed (1-255) (40) | : |
| Enter row pusher speed (1-255) (40) | : |
| Enter cuvette comb speed (1-255) (60) | : |
| Adjust waste disposal band run time (x 40ms) (70) | : |
| Adjust mixing duration (x 40ms) (25) | : |

This is irrelevant for service use.

ATTENTION!

Disregard can cause damage to the AMAX CS-190!



<E> : Exits the cuvette magazine service program. The screen displays:

- - - AMAX service program main menu - - -

11.4 Reagent-Plasma-Tray

<F4> opens the window “Reagent-Plasma-Tray Service Program” (Pic. 11.4.1):

Pic. 11.4.1

```

*****
*
*
*   REAGENT - PLASMA - TRAY SERVICE PROGRAM
*   =====
*
*
*   © MM/YY Heinrich Amelung GmbH
*
*   Written by A.Cramer
*
*   Machine : AMAX
*
*   Carry on with any key
*****

```

Pic. 11.4.2 shows each of the window’s executable commands.

Pic. 11.4.2

```

Service program reagent-plasma-tray AMAX

Program menu :
=====

0...Show current rotor position
1...Display module report
2...Test AML-Bus connection
3...Execute software reset
4...Display light barriers reset and lid
5...Execute test routine
8...Move rotor
9...Switch barcode scanner beam on
S...Scan barcodes
I...Identify barcode scanner version
M...Measure and display cooling temperature
R...Switch mixer on/off and adjust rotational speed
E...End program

Please choose :

```

Press keys <0> - <E>.

- <0>** : Confirms that the reagent-plasma-tray voltage has been turned off. The position display can be checked by manually repositioning the tray.

Pic. 11.4.3

Show current servo axis position :
=====
Servo motor is turned off !
Abort with ESC !
Current position is : X XXXX

- <1>** : Display of the module report.

Pic. 11.4.4

The module reports are :
=====
Module short report is :
AMAX REAGENZRAD PROTOTYP A. CRAMER
WAXXXX
Module: RPB Version: X Date: DD.MM.YYYY
Carry on with any key

- <2>** : Starts the AML-BUS test. The AML-Bus test is used to check the communication between the reagent-plasma-tray and the commander PC. Should a problem occur (interruption), it can be determined here.

⇒ **Error message**

Pic. 11.4.5

Test AML-Bus connection :
=====
Abort with ESC
No. of tests : 5

- <3>** : Resets the reagent-plasma-tray. All parameters are reset to their original values and the tray is moved to the reference position.

Pic. 11.4.6

Transmit softreset to reagent-plasma-tray :
=====
Please wait
Carry on with any key

<4> : Displays the status of all reagent-plasma-tray light barriers. Functionality check of the light barrier and the Lid query.

Pic. 11.4.7

```
Display light barrier status :
=====

Abort with ESC !

Light barrier reset rotor      : high
Light barrier top              : low
```

<5> : The reagent-plasma-tray carries out a test routine. The setup of the emergency cut off can be checked. Should plasma tubes be placed in the sample tray, they can be read by the barcode scanner.

Pic. 11.4.8

```
Execute test routine :
=====

Abort with ESC !

No. of tests :

Position no. XX in ring no. 1 rotate to XYZZ !
```

<8> : The rotor can be turned by entering the position, which ring # and sample tube position.

Pic. 11.4.9

```
Move rotor :
=====

Move the tube to XYZZ or to Scanner (X/B) (E=Ende) :

Which ring should be positioned (1-5)           :

Which tube should be positioned (1-30)           :
```

<9> : Switches on the barcode scanner beam.

Pic. 11.4.10

```
Switch barcode scanner beam on :
=====

Press <L> or <K> to switch beam on
<ESC> to abort !
```

<S> : After entering the ring and tube data, the barcode of the corresponding tube can be read.

Pic. 11.4.11

```
Read barcodes :
=====

Which ring shall be read (1-5)           :

Which vessel shall be read (1-30)        :
```

<I> : The module report of the barcode scanner can be read here (possible only when a barcode scanner of the old generation is installed).

Pic. 11.4.12

```
Query module report barcode scanner :
=====

Module report is :

Carry on with any key
```

<M> : The temperature of the reagent-plasma-tray is measured and displayed.

Pic. 11.4.13

```
Measure and display cooling temperature :
=====

Abort with ESC !

    The current temperature is : 15.5 °C

    Minimum value : 15.4

    Maximum value : 15.8
```

<R> : The rpm of the reagent mixer can be altered.

Pic. 11.4.14

```
Switch mixer on/off and adjust rotational speed :
=====

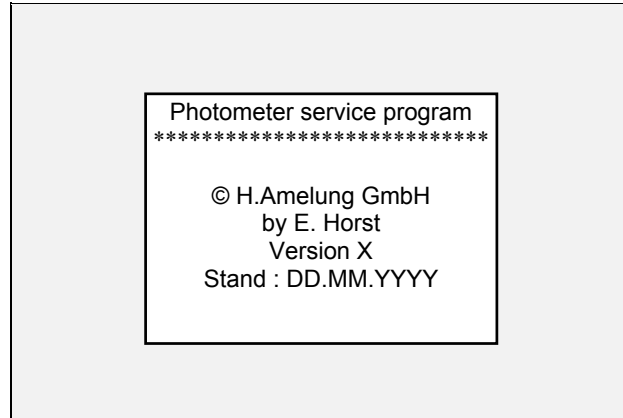
Enter mixer rotational speed (1 - 20000, 0 = off) :
```

<E> : Exits the reagent-plasma-tray service program. The screen displays:
- - - AMAX service program main menu - - -

11.5 Photometer

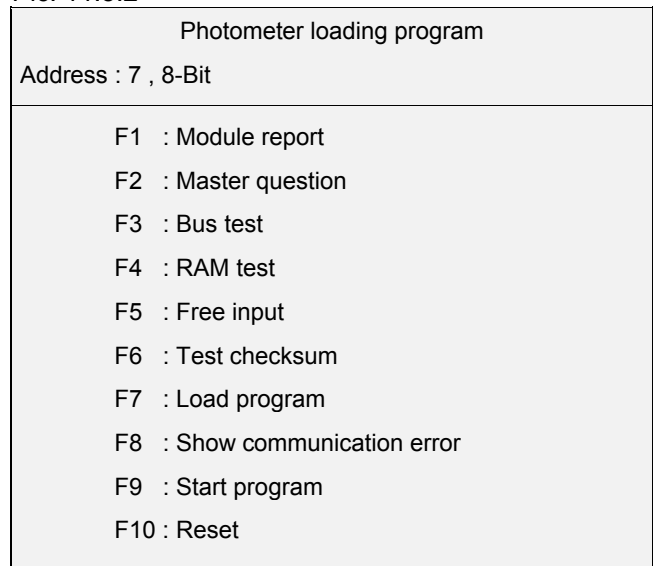
<F6> opens the window "Photometer service program" (Pic. 11.5.1)

Pic. 11.5.1



The window with the photometer loading program opens. (Pic.11.5.2)

Pic. 11.5.2



Use the function keys <F1> - <F10> for accessing each program parts.

In the following sections, the display of each program part is described individually:

<F1> : The module report is displayed.

Pic. 11.5.3

Module report :

PHOTOMET 8-BIT XXXXXX V X.X NEUE RK
 NEUES GERADE-VERFAHREN
 NEUE CHROMOGEN-TABELLE TEMPCORR
 Kurzmeldung PHM VXX TT.MM.JJJJ

<F2> : The master question is queried here. The answer is displayed on the screen.

Pic. 11.5.4

Answer master question : 2

0	B7 Last command is executed
0	B6 Communications error
0	B5 Channel error
0	B4 Temperature error
0	B3 Lamp error
0	B2 AD-converter error
1	B1 1 = load program 0 = measuring program
0	B0 Measured values can be queried

<F3> : Starts the AML-BUS test.
 The communication between the photometer and the commander PC is tested. Should a problem (interruption) occur, it can be determined here.

⇒ **Error message**

Pic. 11.5.5

How often shall the test be repeated ? X

No. of tests :

Number of error runs : X corresponds to X.X%

<F4> : Tests the memory on board PH-O-RK (D02501).

This is irrelevant for service use.

Pic. 11.5.6

RAM test:

Please wait

RAM test:

RAM test OK

<F5> : A command in the hexadecimal format can be entered here.

This is irrelevant for service use.

Pic. 11.5.7

Order to transmit (in Hex) :

<F6> : The installed photometer program is checked.

This is irrelevant for service use.

Pic. 11.5.8

Test checksum:

Checksum OK

<F7> : The photometer program can be loaded manually. Enter:

photonp.bin

The program is being loaded.
This is made visible by the running series of numbers.

Pic. 11.5.9

File name and path :
File name and path: photonp.bin
Line no.: 18
S11F41D47F4520FB41D008201942D0034C96454C5E
Program code is now loaded, OK !

IMPORTANT!

The program needs to be started only once, when the PH-O-RK board is taken into operation the first time. The user interface software program loads the program when booting. This enables automatic updating should a new version have been installed.



<F8> : Errors are displayed.

Pic. 11.5.10

Answer communications error : 0	
0	B7
0	B6
0	B5
0	B4
0	B3
0	B2
0	B1 Wrong command
0	B0 Wrong area

<F9> : The photometer measuring program is started.

Pic. 11.5.11

Photometer measuring program	
Address : 7 , 8-Bit	
F1	: Module report
F2	: Master question
F3	: Display communications error
F4	: Lamp control
F5	: Free input
F6	: Measurement
F7	: Every value
F8	: Measure temperature
F9	: Get chromogen time
F10	: Reset
ALT F1 : Bus test ALT F2 Offset calibration	

<F1> : The module reports are displayed.

Pic. 11.5.12

Module reports :
PHOTOMET 8-BIT XXXXX V X.X NEUE RK NEUES GERADE-VERFAHREN
NEUE CHROMOGEN-TABELLE TEMPCORRKANAL 8- 11
Short message PHM V XX TT.MM.JJJJ
AD-converter ADW V XX TT.MM.JJJJ

<F2> : The master question is asked here. The answer is displayed on the screen.

Pic. 11.5.13

Answer master question : 8	
0	B7 Last command is executed
0	B6 Communications error
0	B5 Channel error
0	B4 Temperature error
1	B3 Lamp error
0	B2 AD-converter error
0	B1 1 = load program 0 = measuring program
0	B0 Measured values can be queried

<F3> : The errors are displayed here.

Pic. 11.5.14

Answer communications error : 8	
0	B7
0	B6
0	B5
0	B4
1	B3 Not ready

0	B2 Already occupied
0	B1 Wrong command
0	B0 Wrong area

<F4> : Here the current lamp status is displayed. The lamp can be switched to different conditions. A control error is displayed because the measuring program is activated but the lamp is not.

<1> : Switches on the lamp. The (1) switches to B2. The lamp controller then sets the lamp to operation voltage (Control range between approx. 10-13.8 Volt). If the lamp voltage is inside of this range, the light switches to B0 (after approx. 90sec.) Is the lamp voltage outside of zone B0, the (1) switches to B3 lamp control error. In this case the lamp must be checked or replaced if necessary.

Pic. 11.5.15

Lamp status:	
0	B7
0	B6
0	B5
0	B4 Lamp temperature elevated
1	B3 Lamp control error
0	B2 Lamp on but not ready
0	B1 Lamp in Standby
0	B0 Lamp on
1 =	Lamp on
2 =	Lamp off
3 =	Lamp in Standby
Please enter	

<2> : Switches off the lamp.

<3> : The lamp is switched to standby (the voltage is decreased).

<F5> : A command in hexadecimal format can be entered here.

This is irrelevant for service use.

Pic. 11.5.16

Order to send (in Hex) :

<F6> : Measurements can be started here. Also, the photometer can be adjusted here.

Pic. 11.5.17

Measuring
Channel 11 10 9 8 7 6 5 4 3 2 1 0
Occup. 0 0 0 0 0 0 0 0 0 0 0 0
1 = Determine blank value
2 = Abort off channel
3 = Start channel clotting
4 = Start channel chromogen
5 = Retrieve result
6 = show 4 channels (0-3)
7 = show 4 channels (4-7)
8 = show 4 channels (8-11)
9 = Values channel 0-7
A = Values channel 8-11

Please enter :

<F7> : One channel is displayed on the screen.
A determined value can be stored and viewed. The display values (reference voltage & multiplier) can be changed as necessary.

Pic. 11.5.18

Transmit every value
Which channel (0-11) ?
12 = last measurement
13 = change file name

<F8> : The temperature of the photometer can be measured. The display can be altered with the keys **<+>** / **<->** (temperature display adjustment). A message (red characters) will indicate that the value was altered. Key **<0>** resets it to its original value.

Pic. 11.5.19

Measure temperature
37.5°C
0 + -

<F9> : Displays which chromogenic measuring mode is stored under a code number in the currently loaded photometer program.

Pic. 11.5.20

Display chromogen time
Which measuring mode ?

<F10> : Transmits a reset to the PH-O-RK board.

IMPORTANT!

The commands for adjusting the photometer amplifier will be described in detail in the following pages.



Adjusting the photometer

The photometer service program is needed to adjust the photometer. The following steps describe how to adjust the photometer measuring amplifier. This adjustment should be carried out in the instrument (photometer installed). The measuring unit has to be protected from any other light sources. The waste disposal drawer has to be closed. The photometer temperature and the lamp voltage have to be adjusted correctly.

Ensure the photometer temperature and voltage adjustments have to be carried out first.



8.5

The AMAX CS-190 has to be connected to the commander PC.



7.5

In order to adjust the measuring amplifier (amplifier compl. Q10150), the following instrument casings have to be removed:

Upper casing (123290)
Side casing left (123289)
Working area (123292)

<F9> : Starts the photometer measuring program.

Pic. 11.5.21

Photometer measuring program	
Address : 7 , 8-Bit	
F1	: Module report
F2	: Master question
F3	: Communications error
F4	: Lamp control
F5	: Free input
F6	: Measurement
F7	: Every value
F8	: Measure temperature
F9	: Query chromogen time
F10	: Reset
ALT F1 Bus test ALT F2 Offset calibration	

<F6> : The window “measurements” opens.
The keys **<6>**, **<7>**, **<8>** select the four / eight / twelve photometer channels.

Pic. 11.5.22

Measurements	
Channel	11 10 9 8 7 6 5 4 3 2 1 0
Occup.	0 0 0 0 0 0 0 0 0 0 0 0
1 = Determine blank value	
2 = Abort channel	
3 = Start channel clotting	
4 = Start channel chromogen	
5 = Retrieve result	
6 = Show 4 channels (0-3)	
7 = Show 4 channels(4-7)	
8 = Show 4 channels(8-11)	
9 = Which channel 0-7	
A = Which channel 8-11	
Please enter :	

Carry out the offset adjustment: The adjustment takes places at the measuring amplifier (amplifier compl. (Q10150)).

IMPORTANT!

The lamp has to be switched off.



<F6> : (see Pic. 11.5.22)

<6> :

*Enter: 0**Enter: 1000*

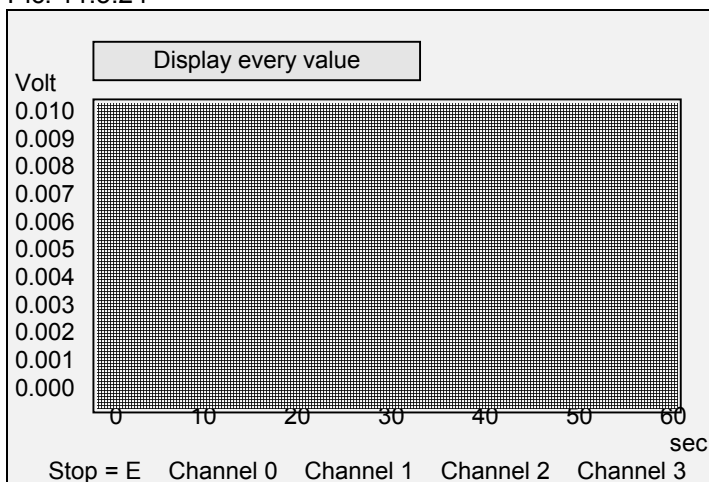
Pic. 11.5.23

Base voltage ?

Multiplier ?

Pic. 11.5.24

The channels are displayed in a graphic. Using the offset potentiometer (lower potentiometer), the channels are adjusted so that all lines on the screen are positioned between 0 and 0.001 volts (approx. 5-10 digits). Actual value: 0.0005-0.001 Volt.



1↗ = approx. + 4.5mV(approx. + 28 digits) /
 1↘ = approx. - 4.5mV(approx. - 28 digits)

<9> : The digits (channel 0-7) are displayed.

Pic. 11.5.25

Channel 0 = 06
 Channel 1 = 05
 Channel 2 = 08
 Channel 3 = 10
 Channel 4 = 09
 Channel 5 = XX
 Channel 6 = XX
 Channel 7 = XX

Carry out the amplifying adjustment: The adjustment takes place at the measuring amplifier (amplifier compl. (Q10150).

IMPORTANT!

There must be no cuvettes in the measuring channels. But first the lamp has to be turned on.



<F4> : With the menu "lamp status", the current lamp status can be queried. The lamp can be switched to different states.

<1> : The lamp is turned on; it takes about 90 sec until the lamp is operational. The display then changes to "lamp on". The lamp voltage should be approx. 11.0 ± 0.5 volts. Otherwise, the voltage at the points X5 & X6 (lamp cable connection) can be measured and adjusted on the AM-O-LSR (D04301) board using the Potentiometer **R50**.

Pic. 11.5.26

Lamp status:	
0	B7
0	B6
0	B5
0	B4 Lamp temperature elevated
0	B3 Lamp control error
1	B2 Lamp on but not ready
0	B1 Lamp in standby
0	B0 Lamp on
1 =	Lamp on
2 =	Lamp off
3 =	Lamp standby
Please enter	

$1\mu\text{A} = \text{approx. } - 200\text{mV} / 1\mu\text{A} = \text{approx. } + 200\text{mV}$

<F6> : (see Pic. 11.5.22)

<6> :

Enter: 8.2

Enter: 100

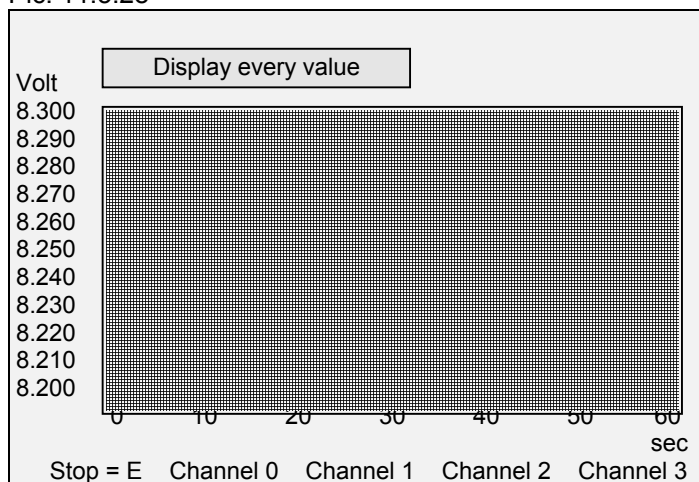
Pic. 11.5.27

Base voltage ?

Multiplicator ?

Pic. 11.5.28

The channels are displayed in a graphic. Using the amplifier potentiometer (upper potentiometer), the channels are adjusted so that all lines on the screen level out at 8.25 volts (54000 digits).
Actual value:
 8.25 ± 0.1 volts.



1↗ = approx. + 225mV(approx. + 1800 Digits) /
1↘ = approx. - 225mV(approx. - 1800 Digits)

<9> : The digits (channel 0-7) are displayed.

Pic. 11.5.29

Channel 0 = 54122
Channel 1 = 54023
Channel 2 = 54321
Channel 3 = 54224
Channel 4 = 54522
Channel 5 = 54002
Channel 6 = 53922
Channel 7 = 53992

After the successful adjustment, the lamp can be switched back off again and the program can be ended.

IMPORTANT!

In the user software (main menu), the photometer now has to be calibrated.



11.6 XYZZ-Robot

<F1> opens the window "XYZZ-Robot Service Program" (Pic. 11.6.1):

Pic. 11.6.1

```

*****
*
*
*      XYZZ-ROBOT SERVICE PROGRAM
*      =====
*
*
*      © MM/YY Heinrich Amelung GmbH
*
*      Written by A.Cramer
*
*      Machine : AMAX
*
*      Carry on with any key !
*****

```

Picture 11.6.2 shows the window with all executable commands.

Pic. 11.6.2

```

Service program XYZZ - robot CS-190

Program menu :
=====

A...Show current servo-axis position
M...Display module report
V...Test AML-Bus connection
R...Execute software reset
L...Display light barriers and liquid sensor
T...Execute test routine
Z...Process additional commands (next menu)
H...Test level sensor
D...Z-axis continuous test routine
E...End program

Please select :

```

Press keys <0> - <E>.

<E> : Exits the XYZZ-robot service program.

The screen displays:

--- AMAX service program main menu ---

- <A>** : All current positions of the XYZZ-robot are displayed. All servo motors are powered off, the robot can be moved manually.
- The positions displayed on the screen change.
- (checking the encoders)

Pic. 11.6.3

```

Display current servo axis position :
=====

All servo motors turned off !
Abort with ESC !

Current position X-axis      : 5962      174A
Current position Y-axis      : 1200      04B0
Current position Z1-axis     : 64        0040
Current position Z2-axis     : 64        0040
  
```

- <M>** : Display of the module reports.

Pic. 11.6.4

```

The module reports are :
=====

AMAX XYZZROB PROTOTYP A:CRAMER

Module short message is :

Module: LRB Version: X Datum: DD.MM.YYYY

Carry on with any key
  
```

- <V>** : Starts the AML-BUS test. The communication between the XYZZ-robot and the command PC is checked. Should a problem (interruption) occur, it can be determined here.
- ⇒ **Error message**

Pic. 11.6.5

```

Check AML-bus connection :
=====

Abort with ESC !

Test runs : 5
  
```

- <R>** : Resets the XYZZ-robot. All parameters are reset to their original values and the robot is moved to its home position. (For testing the light barriers and the connection of the boards PH-XYZZ ⇒ PH-LSX)

Pic. 11.6.6

```

Transmit softreset to the XYZZ-robot :
=====

Please wait .....

Carry on with any key
  
```

<L> : All light barriers and height sensor (level sensor) of XYZZ-robot are displayed.

Pic. 11.6.7

Display light barriers and liquid sensor :
=====

Abort with ESC

Light barrier X-reset position	: high
Light barrier Y-reset position	: high
Liquid sensor	: low

<T> : The XYZZ-robot carries out a test routine.
The XYZZ-robot moves through all positions in sequence.

Pic. 11.6.8

Execute test routine :
=====

Abort with ESC !

Move cuvette to : Mechanical measuring unit 0

Drive cycle no.: 0

IMPORTANT!

Ensure that the XYZZ-robot has loaded its *teach file*. Otherwise, some positions can't be reached correctly.
The safety cut-off could be activated.



11.12

8.6

ATTENTION!

Disregard might lead to malfunctions of and cause damage to the AMAX CS-190!



<Z> : Individual commands of the XYZZ-robot can be executed here.
No.1 displays a window.
(see Pic. 11.10.10)

Press keys **<1>** - **<0>**.

Pic. 11.6.9

Work off other commands :
=====

- 1...Move to fix position
- 2...Lower Z1-axis to dispense position
- 3...Lower Z1-axis to washing position
- 4...Lower Z1-axis with liquid sensor
- 5...Lower Z2-axis to photometer position
- 6...Lower Z2-axis to ball position
- 7...Lower Z2-axis to waste cuvette disposal position
- M..Extend Z2-axis carrier
- 8...Move Z-axis to origin position
- 0...Return to main menu

Please select:

IMPORTANT!

Not all combinations are possible: e.g. the command "lower Z1-axis" over a measuring unit will lead to a crash. The desired command should be selected with great care.



<0> : Exits the sub-program "Individual commands" and jumps back to the main menu "Select a sub-program".

ATTENTION!

Disregard might lead to malfunctions of and cause damage to the AMAX CS-190!



<W> : Another window opens. Here a defined position can be selected with the keys **<1>** - **<33>**. The XYZZ-robot moves to these positions after the query, whether it should position the Z1- or the Z2-axis.
(see Pic. 11.6.11)

Pic. 11.6.10

Move to fix position	
1 : Reag. rotor outer ring	20 : Incub. rail pos. 11
2 : Reag. rotor second ring	21 : Incub. rail pos. 12
3 : Reag. rotor third ring	22 : Photometer meas. cell 1
4 : Reag. rotor fourth ring	23 : Photometer meas. cell 2
5 : Reag. rotor inner ring	24 : Photometer meas. cell 3
6 : Well	25 : Photometer meas. cell 4
7 : Decontaminant	26 : Phm. intermediate pos. 1
8 : Well drain	27 : Phm. intermediate pos. 2
9 : Incub. rail ejector	28 : Phm. intermediate pos. 3
10 : Incub. rail pos. 1	29 : Phm. intermediate pos. 4
11 : Incub. rail pos. 2	30 : Mech. measuring cell 1
12 : Incub. rail pos. 3	31 : Mech. measuring cell 2
13 : Incub. rail pos. 4	32 : Mech. measuring cell 3
14 : Incub. rail pos. 5	33 : Mech. measuring cell 4
15 : Incub. rail pos. 6	
16 : Incub. rail pos. 7	
17 : Incub. rail pos. 8	
18 : Incub. rail pos. 9	
19 : Incub. rail pos. 10	
Enter fix position number :	

<H> : The function and the accuracy of the level sensors can be checked here.

Should the level sensors not work properly (tolerance of 50 increments is exceeded), the element has to be aligned once more.

⇒ **Possible error:**

- breakage of the Coax cable
- wrong adjustment
- defect PH-LSX board
- Z-axis guiding block is dirty.
- Tubing guide is not seated correctly.

Pic. 11.6.11

```
Test capacitance level sensor:
=====

Abort with ESC !

Current Z-value :           2696
Average value :           2696
Current deviation:           0
Deviation > 50 Increments : 0
Test runs :                 24
```



8.6

<D> : Both Z-motors execute a test routine. Possible changes of position can be determined.

Pic. 11.6.12

```
Test both Z-axes :
=====

Please remove the cover and the inlays from the RPB-tray!
Carry on with any key

Abort with ESC !

Drive cycle no.: 1
```

<E> : Exits the XYZZ-robot service program. The screen displays:

- - - **AMAX service program main menu** - -

11.7 Liquid Management

<F5> opens the window “Liquid Management Service Program (Pic. 11.7.1):

Pic. 11.7.1

```

*****
*
*
*      LIQUID MANAGEMENT SERVICE PROGRAM
*      =====
*
*
*      © MM/YY Heinrich Amelung GmbH
*
*      Written by A.Cramer
*
*      Machine : AMAX
*
*      Carry on with any key
*****
  
```

Picture 11.7.2 shows each window’s executable commands.

Pic. 11.7.2

```

Liquid management service program AMAX

Program menu :
=====

P...Adjust rotational speed of hot water circulation pump
M...Display module report
B...Test AML-Bus connection
R...Execute software reset
F...Display liquid level sensors
A...Waste water pump on/off
L...Switch signal lamps
T...Measure and show temperatures
E...End program

Please select :
  
```

Press keys <P> - <E>.

<P> : Adjusts the rpm of the reciprocating pump.
(0 = pump off / 255 = pump on full throughput)

Pic. 11.7.3

```

Adjust rotational speed of reciprocating pump:
=====

Abort with ESC

1...Adjust no. of strokes hot water circuit pump

No. of strokes hot water circuit pump (0 - 255) :
  
```

<M> : Displays the module report.

Pic. 11.7.4

```
Module reports are :
=====

AMAX  WASSER  PROTOTYP A:CRAMER

Module short message :

Module: WKL Version: X Datum: DD.MM.YYYY

Carry on with any key
```

**** : Starts the AML-BUS test.

The communication between the water circuit and the command PC is checked. Should a problem (interruption) occur, it can be determined here.

⇒ **Error message**

Pic. 11.7.5

```
Check AML-Bus connection :
=====

Abort with ESC

Test runs : 5
```

<R> : Resets the water circuits.

All parameters are restored to their original values.

Pic. 11.7.6

```
Send softreset to the water circuits :
=====

Please wait .....

Carry on with any key
```

<F> : Fluid level sensors of all of the water circuits are queried and displayed. This is the display when the instrument is in a perfect condition. Functionality checks of the fluid level sensors.

Pic. 11.7.7

```
Display liquid level sensors :
=====
Abort with ESC

Hot water circuit      : full
Cooling water circuit  : full
Well XYZZ-robot        : empty
Fresh water reservoir  : full
Waste water reservoir  : empty
Reserve tank top       : full
Reserve tank bottom    : full

Bit 3 : empty

Decimal format : 248
```

<A> : Starts the waste water pump of sub-assembly (Q10013). If necessary the filled well can be drained this way.
Press key <x>.

Pic. 11.7.8

Waste water pump on/off :

=====

Abort with ESC !

x : Start waste water pump for the well XYZZ-robot

<L> : The traffic light lamps are switched on and of in sequence.

Pic. 11.7.9

Switch signal lamps:

=====

Abort with ESC !

Green lamp on



2.2

<T> : The temperature of the warm water / cooling water circuits are measured and displayed.

Pic. 11.7.10

Measure and display temperatures :

=====

Abort wi

Temperature warm water circuit

: 40.5 °C

Temperature cooling water circuit

: 32 °C

Temperature incubation rail

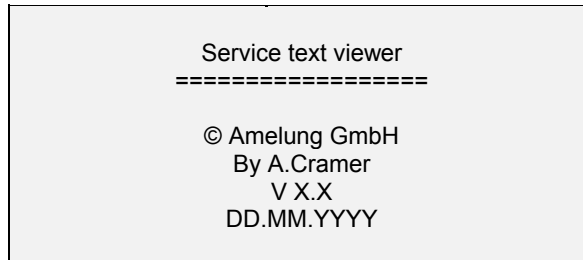
: 37.4 °C

<E> : Exits the water circuit service program. The screen displays:
 - - - **AMAX service program main menu** - - -

11.8 Text Viewer

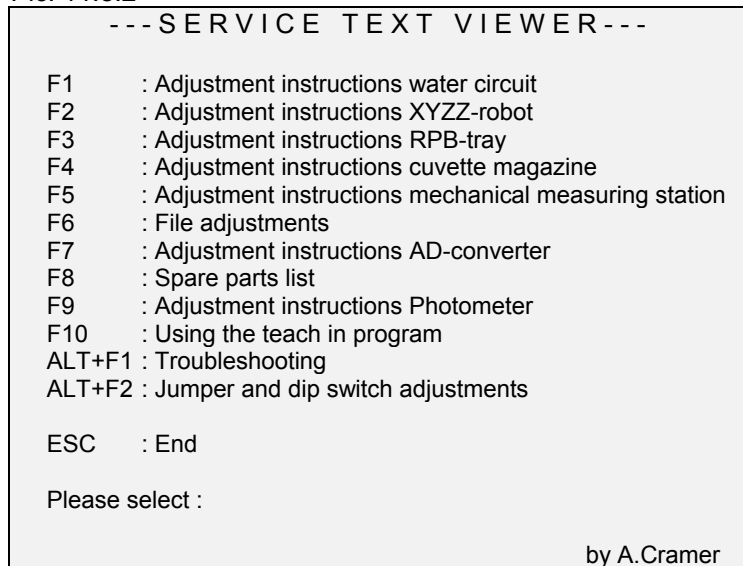
Pressing <ALT+F7> starts the "Service text viewer".

Pic. 11.8.1



Pic. 11.8.2

Pressing the function keys
<F1> - <F10>,
<ALT+F1> & <ALT+F2>
starts each program.



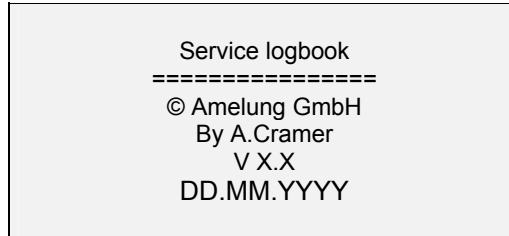
- <F1> , <F2> , <F3> , <F4> , <F5> : Setup parameters for each module.
- <F6> : Opens "Adjustments in files". All parameters which can be adjusted under DOS in the user software (main menu) are displayed here. These adjustments should be carried out only by trained service technicians in order to avoid malfunction of the AMAX CS-190.
- <F7> : Adjustments instructions for the AD-converter.
This is irrelevant for service use.
- <F8> : Displays the spare parts list of the AMAX CS-190. All parts which are necessary for the repair and maintenance of the AMAX CS-190 are listed there.
- <ESC> : Exits the service text viewer and the screen displays:

- - - AMAX service program main menu - - -

11.9 Service Logbook

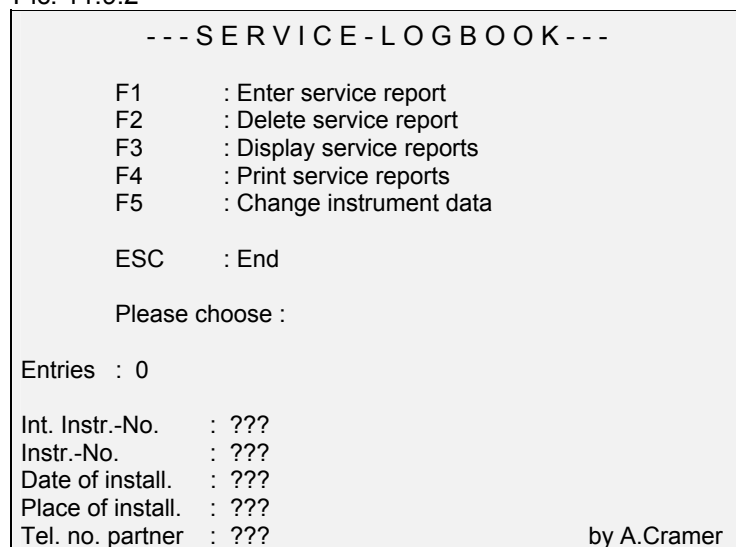
Pressing <ALT+F6> starts the "Service logbook".

Pic. 11.9.1



Pic. 11.9.2

Pressing the keys <F1> - <F5> starts each program.



- <F1> : Add a service report to the list.
- <F2> : Deletes the highlighted entry from the list.
- <F3> : Shows all service reports.
- <F4> : Prints the service reports. You can choose between printing the whole list and printing selected reports only.
- <F5> : The instrument data has to be entered here. The int. Device No. can be found behind the waste disposal drawer. It is printed on the base frame. The Device No. is printed on the instrument series number label.

IMPORTANT!

The service logbook should be created after every instrument installation. Every service intervention should be entered in the logbook.



<ESC> : Exits the service logbook program. The screen displays:

--- AMAX service program main menu ---

11.10 AMAX Teach in Program

The XYZZ positions are aligned by using the XYZZ teach in program. The robot moves to the positions using predefined data, but the correct positions differ from instrument to instrument ⇒ **Tolerance**.

With this program, the positions can be adjusted in such a way that the Z-axes can move precisely to all instrument positions (e.g. to drive exactly into the middle of a vial opening).

NOTICE!

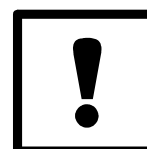
The mechanical reset switch of the robot has to be activated.



8.6

ATTENTION!

Disregard may lead to malfunctions of and cause damage to the AMAX CS-190!



Pressing **<F8>** starts the service program "AMAX teach in program".

Pic. 11.10.1

AMAX Teach in program
=====
© MM/YYYY H. Amelung GmbH
Written by A.Cramer
TT.MM.YYYY

Pic. 11.10.2

The path and file name can be altered here.

A suggestion, which can be used, is already entered.

<ESC> : deletes the entry.

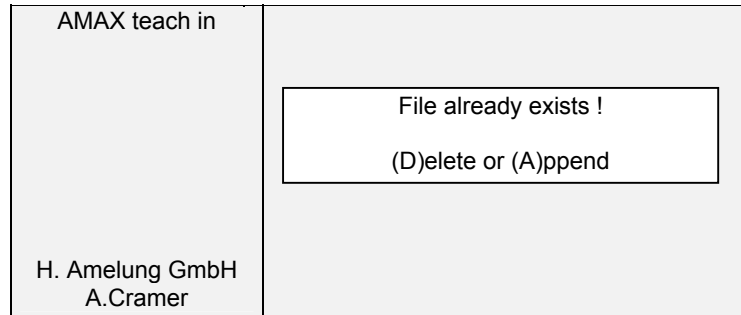
<ENTER> : accepts the entry.

AMAX teach in	Path a. File name Offset - file : ENTER = accept, ESC = new entry C:\AMAX\OFFSET.DAT
H. Amelung GmbH A.Cramer	

The file "OFFSET.DAT" is created. In this example, it already exists.

- <L>** : deletes the file.
All data is lost. In this case, the teach in program has to be carried out completely.
- <A>** : The data is attached (appended). Individual positions can be altered (aligned).

Pic. 11.10.3



The pointer (=>) makes the selection.
It can be moved with the <↓>, <↑> keys on the PC keyboard.

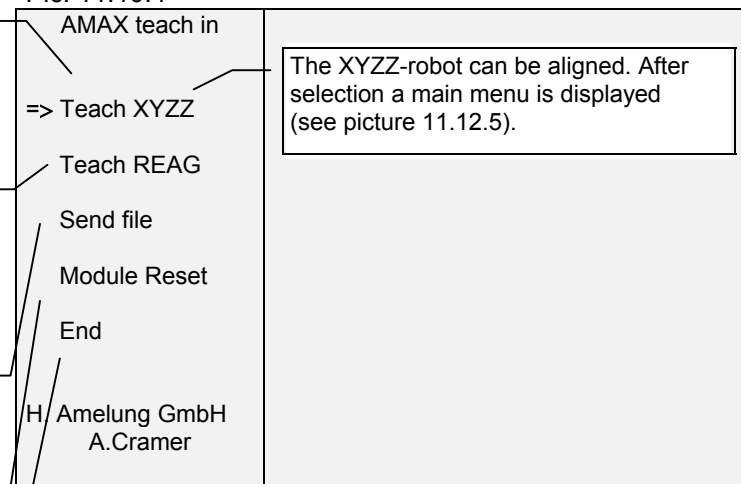
The reagent-plasma-tray can be aligned.
This is irrelevant for service use.

The file "OFFSET.DAT" is transmitted. After a reset, the data has to be transmitted in order to provide the robot with its position data.

The module XYZZ-robots and the reagent-plasma-tray carry out a reset.

Ends the AMAX teach in program.

Pic. 11.10.4

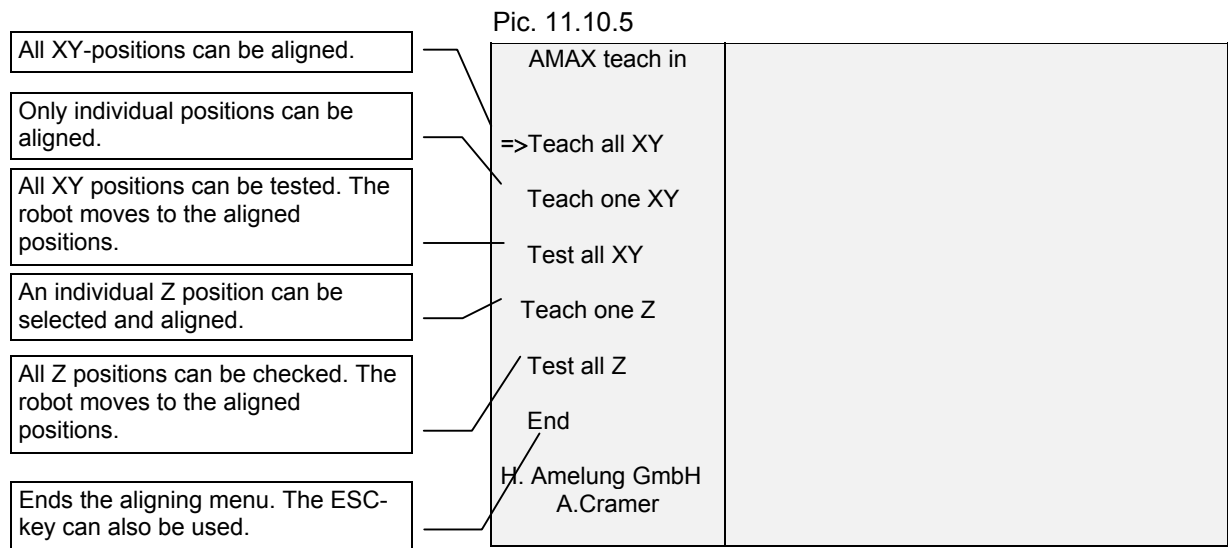


IMPORTANT!

The following points have to be carried out before the aligning.

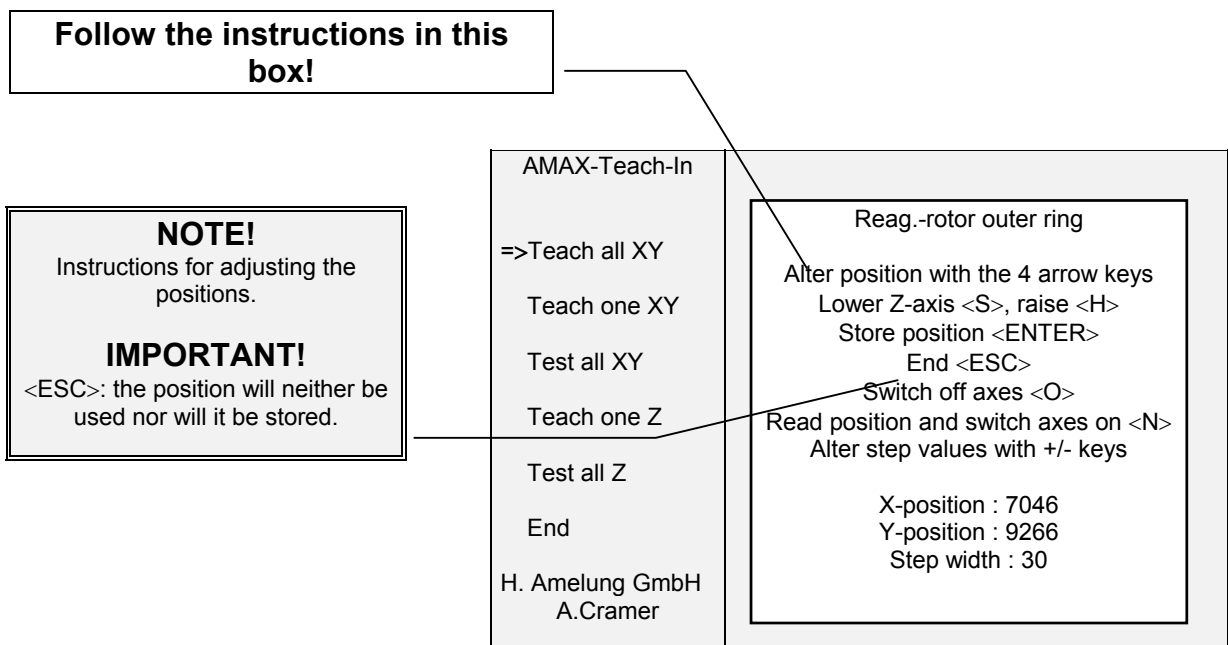
1. XYZZ reset
2. Wait until the XYZZ robot has reached his reference position.
3. Send file.





...**Teach all XY positions:** the XYZZ-robot moves to all XY-positions in sequence. There is a window for every position: Example in picture 11.10.6.

Pic. 11.10.6



Before the XY-positions can be aligned, the offset for the Z1 / Z2-axis has to be adjusted **first**.

Select the point: "Align a Z-axis" (Picture 11.10.5(6))

Offset Z1 / Z2 Axis is loaded. The XYZZ-robot moves with the Z1-axis to the position (mechanical measuring cell 4).

The Z-axis lowers. It should to be in the center of the measuring cell, otherwise, the position has to be corrected. When the axis has reached its position, confirm with **<ENTER>** and the Z2-axis moves into the measuring cell. This position also has to be corrected if necessary. Confirm with **<ENTER>**. This program point has been completed and the window "teach in" appears (Picture 11.10.5(6)).

Now, the XY position can be aligned. In addition, all positions can be aligned manually. This means that the XYZZ-robot is moved to the desired positions manually after its motors have been switched to "power off". The position is read in by pressing **<N>** and the motors are switched back on. **<ENTER>** stores the position.

When all XY-positions are adjusted, the Z-positions can now be adjusted.

IMPORTANT!

Do not adjust the offset Z1 / Z2-axis any more.



After successfully aligning the XYZZ-positions, end the program by executing the command "end". Only then is the file stored on the hard disk of the commander PC.

The screen displays:

- - - AMAX service program main menu - - -

ATTENTION!

Disregard may lead to malfunction and cause damage to the AMAX CS-190.



11.10.1 Adjustable XY-Positions

Tab. 11.10.1.1

Position <i>XY-positions</i>	Axis	Position to be aligned
Reag. rotor outer ring	Z1	Center of vial
Reag. rotor second ring		
Reag. rotor third ring		
Reag. rotor fourth ring		
Reag. rotor inner ring		
Well (align ejector)	Z1 (Z2)	The XY-position must be aligned so that it matches the pick up position for a cuvette in the incubation rail, (incub. rail ejector) position.
Decontaminant	Z1	Adjust the XY-position so that the Z1-axis can move into the decontamination reservoir position.
Well drain	Z1	Adjust the XY-position so that the Z1-axis moves directly over the drain.
Incub. rail ejector	Z2	Adjust the XY-position so that the Z-axis (cuvette ejector, tappet) can move into the opening of the incubation rail.
Incub. rail position 1	Z1	Center of the opening in the incubation cover
Incub. rail position 2		
Incub. rail position 3		
Incub. rail position 4		
Incub. rail position 5		
Incub. rail position 6		
Incub. rail position 7		
Incub. rail position 8		
Incub. rail position 9		
Incub. rail position 10		
Incub. rail position 11		
Incub. rail position 12		
Photometer meas. channel 1	Z2	Adjust the XY-position so that the Z-axis (cuvette ejector, tappet) can move into the measuring cell
Photometer meas. channel 2		
Photometer meas. channel 3		
Photometer meas. channel 4		
Photometer intermediate pos. 1	Z2	Adjust the XY-Position so that the carrier can open the measuring channel cover. The carrier should be positioned approx. 3 mm beside the opener of the measuring channel cover.
Photometer intermediate pos. 2		
Photometer intermediate pos. 3		
Photometer intermediate pos. 4		
Mech. meas. channel 1	Z2	Adjust the XY-position so that the Z-axis (cuvette ejector, tappet.) can move into the measuring channel.
Mech. meas. channel 2		
Mech. meas. channel 3		
Mech. meas. channel 4		

All XY-positions listed in Tab 11.10.1.2 are default values.
The default values are used by the software without the file "OFFSET.DAT". The positions can be altered by aligning.

Tab. 11.10.1.2

Position	Default-values
Reag. rotor outer ring	X-position : 7046 / Y-position : 9266
Reag. rotor second ring	X-position : 5592 / Y-position : 10473
Reag. rotor third ring	X-position : 3146 / Y-position : 12260
Reag. rotor fourth ring	X-position : 2455 / Y-position : 12933
Reag. rotor inner ring	X-position : 488 / Y-position : 14414
Well (align ejector)	X-position : 5962 / Y-position : 1202
Decontaminant	X-position : 1954 / Y-position : 1202
Well drain	X-position : 4770 / Y-position : 1202
Incub. rail ejector	X-position : 8056 / Y-position : 1370
Incub. rail position 1	X-position : 9706 / Y-position : 1238
Incub. rail position 2	X-position : 11510 / Y-position : 1238
Incub. rail position 3	X-position : 13312 / Y-position : 1238
Incub. rail position 4	X-position : 15095 / Y-position : 1238
Incub. rail position 5	X-position : 16919 / Y-position : 1238
Incub. rail position 6	X-position : 18684 / Y-position : 1238
Incub. rail position 7	X-position : 20486 / Y-position : 1238
Incub. rail position 8	X-position : 22279 / Y-position : 1238
Incub. rail position 9	X-position : 24091 / Y-position : 1238
Incub. rail position 10	X-position : 25886 / Y-position : 1238
Incub. rail position 11	X-position : 27682 / Y-position : 1238
Incub. rail position 12	X-position : 29476 / Y-position : 1238
Photometer meas. channel 1	X-position : 22294 / Y-position : 3919
Photometer meas. channel 2	X-position : 22906 / Y-position : 6330
Photometer meas. channel 3	X-position : 22933 / Y-position : 8774
Photometer meas. channel 4	X-position : 22978 / Y-position : 11196
Photometer intermediate pos. 1	X-position : 18033 / Y-position : 3919
Photometer intermediate pos. 2	X-position : 18033 / Y-position : 6330
Photometer intermediate pos. 3	X-position : 18033 / Y-position : 8774
Photometer intermediate pos. 4	X-position : 18033 / Y-position : 11196
Mech. meas. channel 1	X-position : 17405 / Y-position : 14418
Mech. meas. channel 2	X-position : 22019 / Y-position : 14416
Mech. meas. channel 3	X-position : 26569 / Y-position : 14416
Mech. meas. channel 4	X-position : 31133 / Y-position : 14417

11.10.2 Adjustable Z-Positions

When all XY-positions are adjusted, the Z-Positions can be adjusted.

IMPORTANT!

Do not adjust the offset Z1 / Z2-axis any more.



Tab. 11.10.2.1

Offset Z1/Z2-axis:

Before the XY-positions can be aligned, the offset of the Z1 / Z2-axis should be adjusted.

First the Z1-axis moves to the position mechanical measuring cell 4.

Adjustment: axis in the center of the measuring cell.

Then the Z2-axis moves to the position.

Adjustment: ejector in the center of the measuring cell.



Z2-axis ejector extended:

will not be aligned

Z2-axis photometer:

- switch axes to power off
- push the ejector (Z2-axis) onto the black plastic part of the measuring cell and set the reference position to 0. Move the robot over the measuring cell and push the Z2-axis into the measuring cell until the reference position display says 8.8mm (8.75-8.85).

This position no longer requires adjustment. The position is adjusted automatically with the **service program** "photometer auto align".

After the adjustment with the **service program** "photometer auto align" this command **should not** be executed any more, otherwise the stored position would be overwritten.



11.17

Z2-axis measuring cell:

- switch axes to power off
- put a cuvette into the measuring cell and move the ejector (Z2-axis) on top of it. Switch on Z-axis and set reference position to 0. Next lower the Z2-axis 1mm with the arrow key <↓>.

Z2-axis ejection:

Move the Z2-axis to the mechanical stops using the arrow key <↓> (reference position does not change any more). Set the reference position to 0.00m with the <R> key. Next raise the Z1-axis 2mm with the arrow key <↑>.

Z1-axis dispense in incubation rail and measuring channel:

Lower the Z1-axis so far with the arrow key <↓> that the groove of the needle heating touches the top edge of the rail cover.

Z1-axis washing in wash-well:

Move the Z1-axis down until it touches the floor of the well insert (using the arrow key <↓>). Set reference position to 0.00mm using the <R> key. Next raise the Z1-axis 2m using the arrow key <↑>.

All Z-positions in Tab. 11.10.2.2 are default values.

The default values are used by the software without the file "OFFSET.DAT". The positions can be altered by aligning.

Tab. 11.10.2.2

Position	Default-values
Z2-axis ejector out	Z-position : 215
Z2-axis photometer	Z-position: 1273
Z2-axis measuring channel	Z-position: 1350
Z2-axis ejection	Z-position: 1664
Z1-axis dispense in incubation rail and measuring channel	Z-position: 795
Z1-axis washing in wash-well	Z-position: 623
Offset Z1/Z2-axis	1.X-position: 31133/ 2.X-position: 29183

To check the file "OFFSET.DAT" start the **service program** "AMAX teach in program" by pressing <F8>.

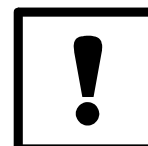
First the XYZZ-robot executes a reset (Pic. 11.10.4). The file will be loaded after the reset is completed (Pic. 11.10.4). Once the file is loaded, the XY-positions can be checked by selecting the menu point "Check all XY" (Pic. 11.10.5(6)).

The XYZZ-robot moves to all XY-positions ⇒ If an adjustment is imprecise, it has to be corrected. If they are correct, the Z-positions can be checked by selecting the menu point "Check all Z" (Pic. 11.10.5(6)).

The XYZZ-robot moves to all Z-positions ⇒ If an adjustment is imprecise, it has to be corrected.

ATTENTION!

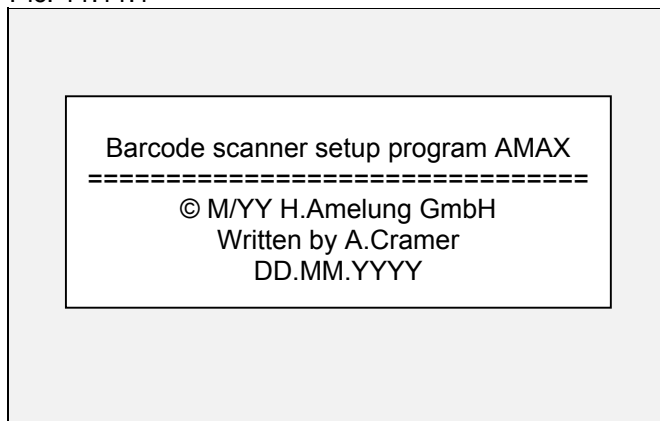
Disregard can lead to malfunction of and cause damage to the AMAX CS-190!



11.11 Barcode Setup

<F10> opens the window Barcode setup AMAX CS-190 (Pic. 11.11.1)

Pic. 11.11.1



Pic. 11.11.2 Setup example

<A> - <O> : Each barcode can be selected (switched on or off)

<Q> : Exits the program and stores the setup.

--- Barcode scanner setup AMAX ---			
A	UPC VD	√	I CODE 11 -
B	UPC/EAN	√	J CODE 39 -
C	CODABAR ABC	-	K CODE 128 -
D	CODABAR	√	L 1. INT2/5 8
E	INT2/5	√	M 2. INT2/5 6
F	DIS2/5	√	N 1. DIS2/5 6
G	CODE 39 FULL	-	O 2. DIS2/5 8
H	CODE 39	√	
Q QUIT			
Use keys A - O to alter adjustments, Q to end the program and store data			

The screen displays:

- - - AMAX service program main menu - - -

IMPORTANT!

The barcode setup program was created only for a particular barcode scanner generation. Should the program not be accessible, the installed scanner does not need to be adjusted.

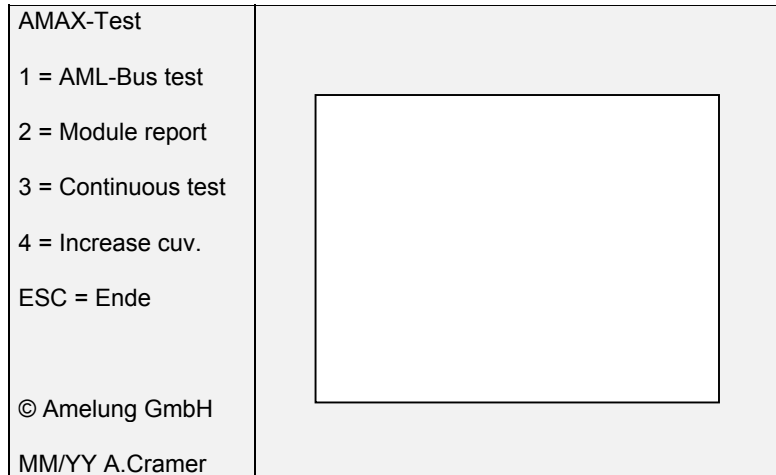


11.12 AMAX Continuous Test Program

Pressing **<ALT+F3>** starts the "AMAX continuous test program".

A window, in which multiple functions can be selected, appears.

Pic. 11.12.1



First, all programs execute a reset. Then, all needed data will be loaded (teach files etc.).

When the screen resembles Pic. 11.12.1, each program can be selected with the corresponding key.

- <1>** : AML-BUS test The complete BUS system is checked. Should an error occur, it will be displayed.
- <2>** : Module report All module reports are displayed on the screen.
- <3>** : Continuous test This program initiates all modules. Its purpose is to simulate a sequence which corresponds to a real measuring process (main software).
- <4>** : Increase cuv. The modules magazine, XYZZ-robot and measuring cells are initiated by this program. Its purpose is to transport cuvettes from the cuvette magazine to any measuring point using the XYZZ-robot.
- <ESC>** : Exits the service program "Continuous test" and the screen displays:

- - - AMAX service program main menu - - -

11.13 AMAX Continuous Test II

Pressing **<ALT+F8>** starts the service program "Continuous test II".

IMPORTANT!

There should be no cuvettes in the robot gantry. If the barcode scanner is also to be checked, a tube with a barcode should be placed in the sample tray position 1. The file OFFSET.DAT has to be in the directory C:\AMAX.



ATTENTION!

Disregard can lead to malfunction of and cause damage to the AMAX CS-190!



All modules are initiated with this program. Its purpose is to check each module individually. This test is stored in a file. This file can be opened and read at a later time.

The name of the file is:

AMAXTEST.LOG

It is in the directory: **C:\AMAX\SERVICE**

Opening the file:

Screen displays:

C:\AMAX\SERVICE

Enter:

EDIT AMAXTEST.LOG

- In contrast to the service program "AMAX self test program" this program works continuously.
- The number of tests is displayed on the screen.
- An information line shows every step of the tests.
- The program can be aborted by pressing the **<ESC>** key.
- When an error has been determined, the program immediately aborts at the point where the error has occurred. The error message is displayed in **red**.
- When no errors have occurred, the program carries on until all modules have been tested once. Then the test cycle starts over.
- Pressing **<ESC>** aborts the program, the screen displays:

- - - AMAX service program main menu - - -

11.14 AMAX Self Test Program

Pressing <F9> starts the "Self test program".

IMPORTANT!

There should be no cuvettes in the robot arm transfer unit. A plastic vial, which is filled with water (ca. 4cm high), has to be placed in the decontaminant position: If the barcode scanner is also to be checked, a tube with a barcode should be placed in sample tray position 1. The file OFFSET.DAT has to be in the directory C:\AMAX.



ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



All modules are initiated with this program. Its purpose is to check each module individually. This test is stored in a file. This file can be opened and read at a later time.

The name of the file is:

AMAXTEST.LOG

It is in the directory: **C:\AMAX\SERVICE**

Opening the file:

Screen display says:

Enter:

**C:\AMAX\SERVICE
EDIT AMAXTEST.LOG**

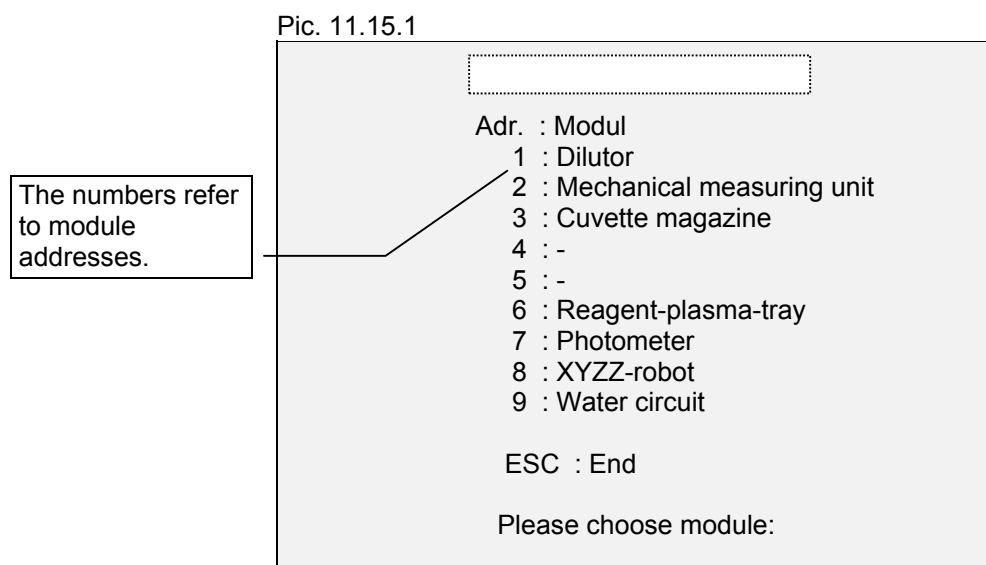
- An information line shows every step of the tests.
- When an error has been determined, the program immediately aborts at the point where the error has occurred. The error message is displayed in **red**.
- When no errors have occurred, the program carries on until all modules have been tested once. The message "No errors have been found in the system" is then displayed and the software switches back to the menu.
- <ENTER> : Exits the program and the screen displays:

- - - AMAX service program main menu - - -

11.15 Error Codes

Pressing <ALT+F1> starts the "Error codes".

The window error codes CS-190 (Pic. 11.15.1) is displayed on the screen.



When selecting a module, you will be asked whether you want to decipher an error code or if you want to inquire an error via the AML-Bus.

- When entering an error code, the description of the error code appears on the screen.
- When making a query using the AML-bus, the description appears on the screen after the corresponding module has been scanned.

Entering the number 20 exits the program. The screen displays:

- - - **AMAX service program main menu** - - -

11.16 AD Converter

Pressing <ALT+F2> starts the "AD converter".

This program cannot be executed. A special board is needed to connect the AD converter.

<ESC> : Exits the "AD converter" and the screen displays:

- - - **AMAX service program main menu** - - -

11.17 Photometer Auto Align

Pressing <ALT+F10> starts the "Photometer auto align".

This program is used to automatically adjust the setup of the Z-axis photometer position.

The adjustment tool (J01817) is placed into the front photometer measuring cell with the hole facing down.

The adjustment gauge is used to find the highest light intensity. Once this value has been found, the Z-axis position is stored when the program is ended by pressing <j>.

Pic. 11.17.1

VX.X DD.MM.YYYY

Automatic alignment photometer depth :

=====

Please insert the adjustment gauge into the photometer channel nearest to you (user position in front of the instrument), level with the black edge of the measuring channel so that the cover can just be closed.

The surface of the adjustment gauge with the hole must be inserted first!

Please clean the waste disposal drawer because the gauge will fall into it!

Proceed with F1, abort with ESC

Measure photometer depth setting

Z-position : XXXXX Light intensity : XXXXX

calculating measuring results...

best Z-position : XXXXX

Should this value be stored in the Teach-in file?

Choose :Y / N

ATTENTION!

The waste drawer has to be cleaned because the adjustment gauge falls into it after the adjustment.

RISK OF INFECTION!



IMPORTANT!

The position "Z-axis photometer position" should not be aligned in the AMAX teach in program any more. Otherwise, the position, which has been aligned in this program would be overwritten.



11.18 Drip Test

Pressing <ALT+F9> starts the "Drip test".

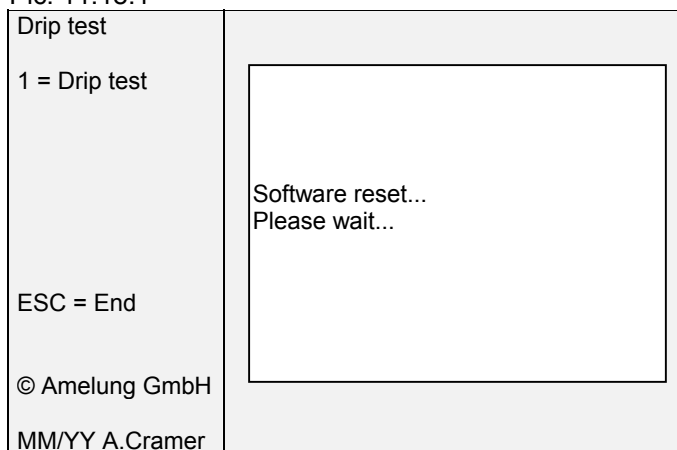
This program is used to check for leakages in the pipetting system. A water drop is formed at the end of the needle. It must not change its size or fall off. Otherwise, the system has a leak which may cause differences in volumes while pipetting.

⇒ Precision problems

<ALT+F9>

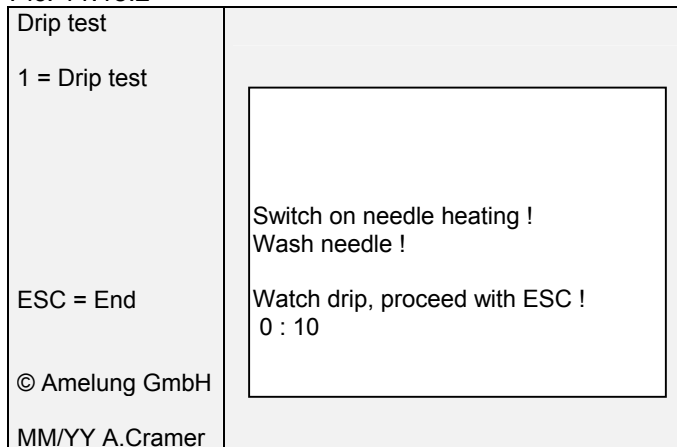
After the start of the program the modules execute a reset.
Then, all necessary files are loaded (e.g. OFFSET.DAT etc.).

Pic. 11.18.1



<1> : starts the drip test.
The needle heating is turned on (pump) and the needle is washed. Then, a water drop is formed at the end of the needle. At the same time a timer is started.

Pic. 11.18.2



ATTENTION!

Disregard can lead to malfunction of the AMAX CS-190!



12. Troubleshooting

12.1

Error Examples

12 – 1

12.1 Error Examples

Tab. 12.1.1

Cause	Effect	Corrective action
AMAX CS-190 does not start up		1. Check the power supply plugs 2. Check the wall socket for voltage
AMAX CS-190 is turned on, but the program doesn't start	No measurement possible	1. Is the PC switched on? 2. Is the connection between the PC and AMAX CS-190 established ? (BUS-cable) 3. Is the program installed?
Instrument becomes too hot	Error message is displayed	1. Check air filter, clean if necessary 2. Check system fluid, refill if necessary 3. Check fluid filter (blockage), replace if necessary
Some temperatures aren't achieved	Error message is displayed	1. Check air filter, clean if necessary 2. Check system fluid, refill if necessary 3. Check fuses in the instrument 4. Check heating, cooling 5. Check system fluid, refill if necessary
There is water under the AMAX CS-190		1. Check the waste and fresh water connections 2. Check drain well for blockage 3. Is the waste water pump working? 4. Tubing defect?
XYZZ-robot is out of order after some time	Error message is displayed	1. Check tension of the drive belts 2. Check positions (teach in) 3. Check movability of all axes and guides, lubricate if necessary 4. Check safety cutoff (voltage)
Mech. meas. unit: Not all knee joints close	Error message is displayed	1. Check disposal drawer (full) 2. Check, if cuvettes have jammed behind the holdings springs in the measuring cells 3. Check functioning of light barrier stepper motor (knee joint)

Cause	Effect	Corrective action
Bubbles in tubing (XYZZ)	Test values out of acceptable range	1. Check integrity of dilutor syringe 2. Check integrity of all connections and joints
Water leakage at the dilutor valve	Test values out of acceptable range	1. Check dilutor needle tubing set for blockage 2. Check needle for blockage
Photometer cannot be adjusted electrically. Range of the potentiometer is insufficient.	Test values out of acceptable range	1. Clean photometer optics 2. Check lamp voltage, replace lamp if necessary
Photometer lamp cannot be turned on in the main menu	Report error photometer lamp	1. Check photometer lamp 2. Check fuses

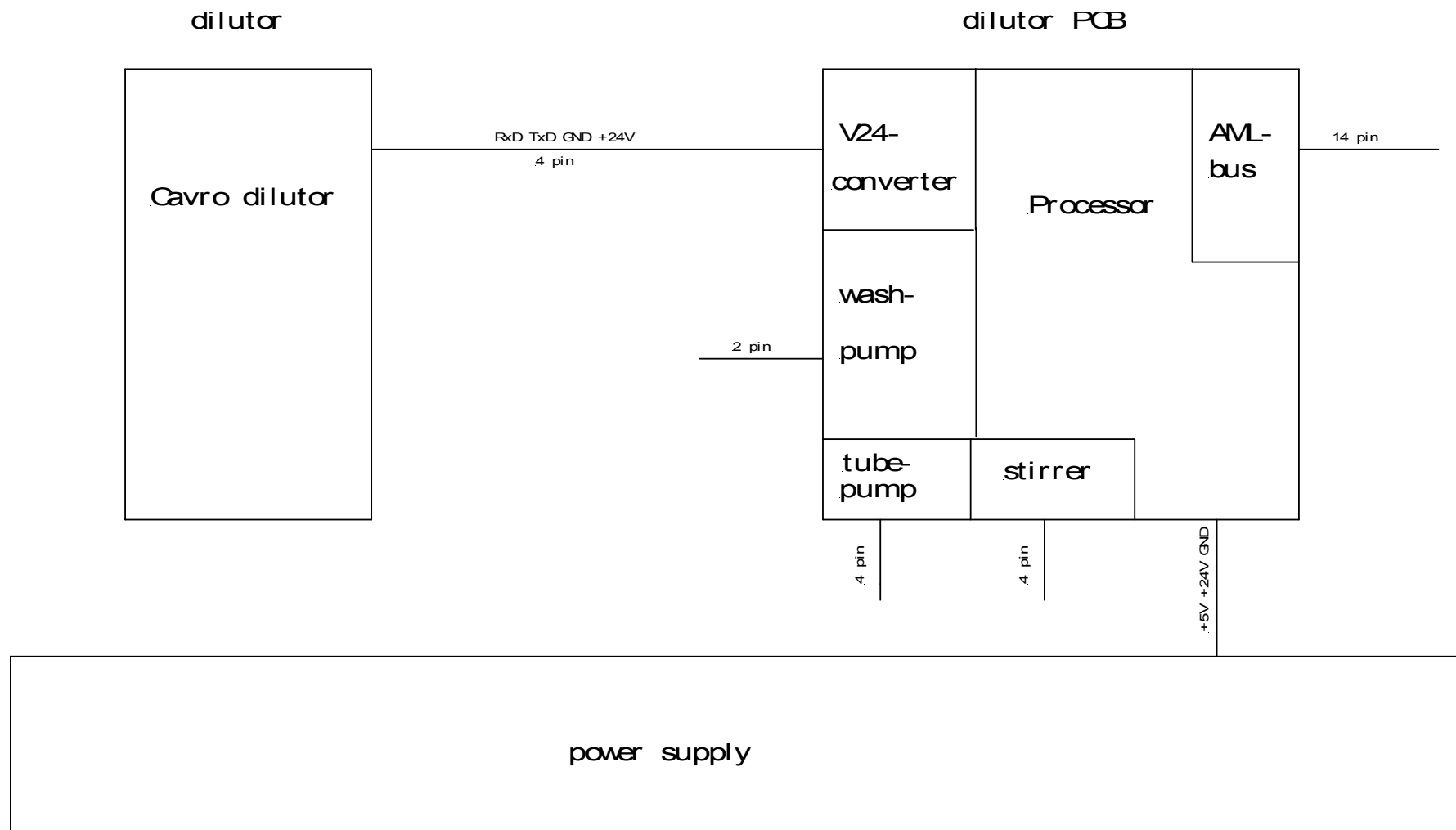
13. Drawings

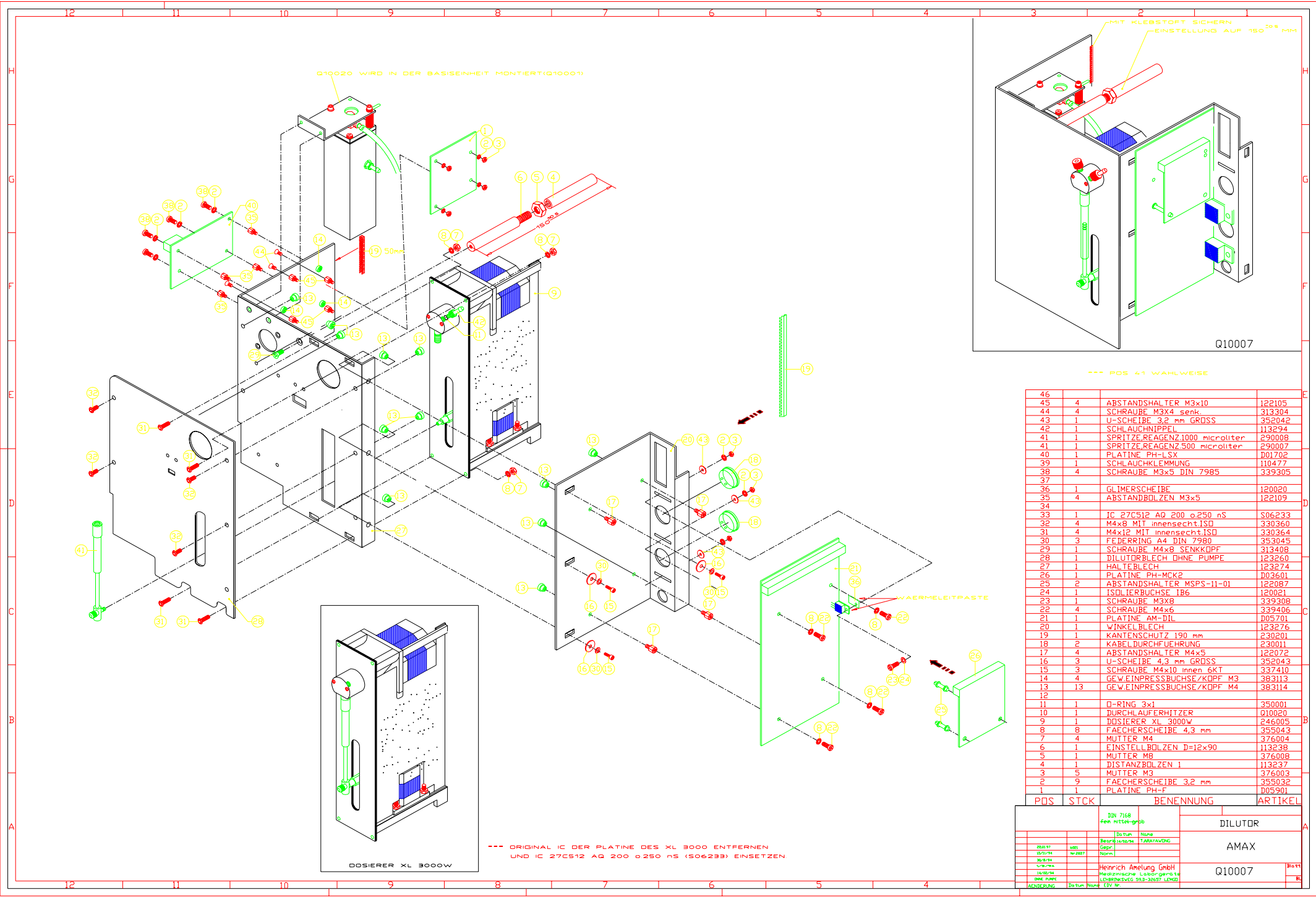
Dilutor Block Diagram	13 – 1
Dilutor Circuit Diagram	13 – 2
Dilutor	13 – 3
Mechanical Measuring Unit (Knee Joint) Block Diagram	13 – 4
Mechanical Measuring Unit Block Diagram	13 – 5
Measuring Block Heating Block Diagram	13 – 6
Mechanical Measuring Unit Circuit Diagram	13 – 7
Mechanical Measuring Unit	13 – 8
Cuvette Magazine PC Board PH-K1 Block Diagram	13 – 9
Cuvette Magazine PC Board PH-K5 Block Diagram	13 – 10
Cuvette Magazine Circuit Diagram	13 – 11
Cuvette Magazine	13 – 12
Slide Pusher I	13 – 13
Slide Pusher II	13 – 14
Incubation Rail	13 – 15
Reagent-Plasma-Tray Block Diagram	13 – 16
Reagent-Plasma-Tray Circuit Diagram	13 – 17
Reagent-Plasma-Tray	13 – 18
Photometer Block Diagram	13 – 19
Optical Measuring Unit Circuit Diagram	13 – 20
Optical Measuring Unit	13 – 21
Measuring Unit	13 – 22
XYZZ-Cantilever Arm Block Diagram	13 – 23
XYZZ Circuit Diagram	13 – 24
Cantilever Arm	13 – 25
Water Temperature Block Diagram	13 – 26
Water Circulation System Circuit Diagram	13 – 27
Water Temperature Control	13 – 28
Water Tank	13 – 29
Water Circulation System	13 – 30
Base Unit	13 – 31
Base Unit	13 – 32
Casing	13 – 33
Light Current Control	13 – 34
Photometer Amplifier	13 – 35
PC-AMAX Circuit Diagram	13 – 36
Wirering for AC/DC-Supply	13 – 37
Moduls PCB Location	13 – 38

● AMELUNG AMAX CS-190

Drawings / Dilutor Block Diagram

13

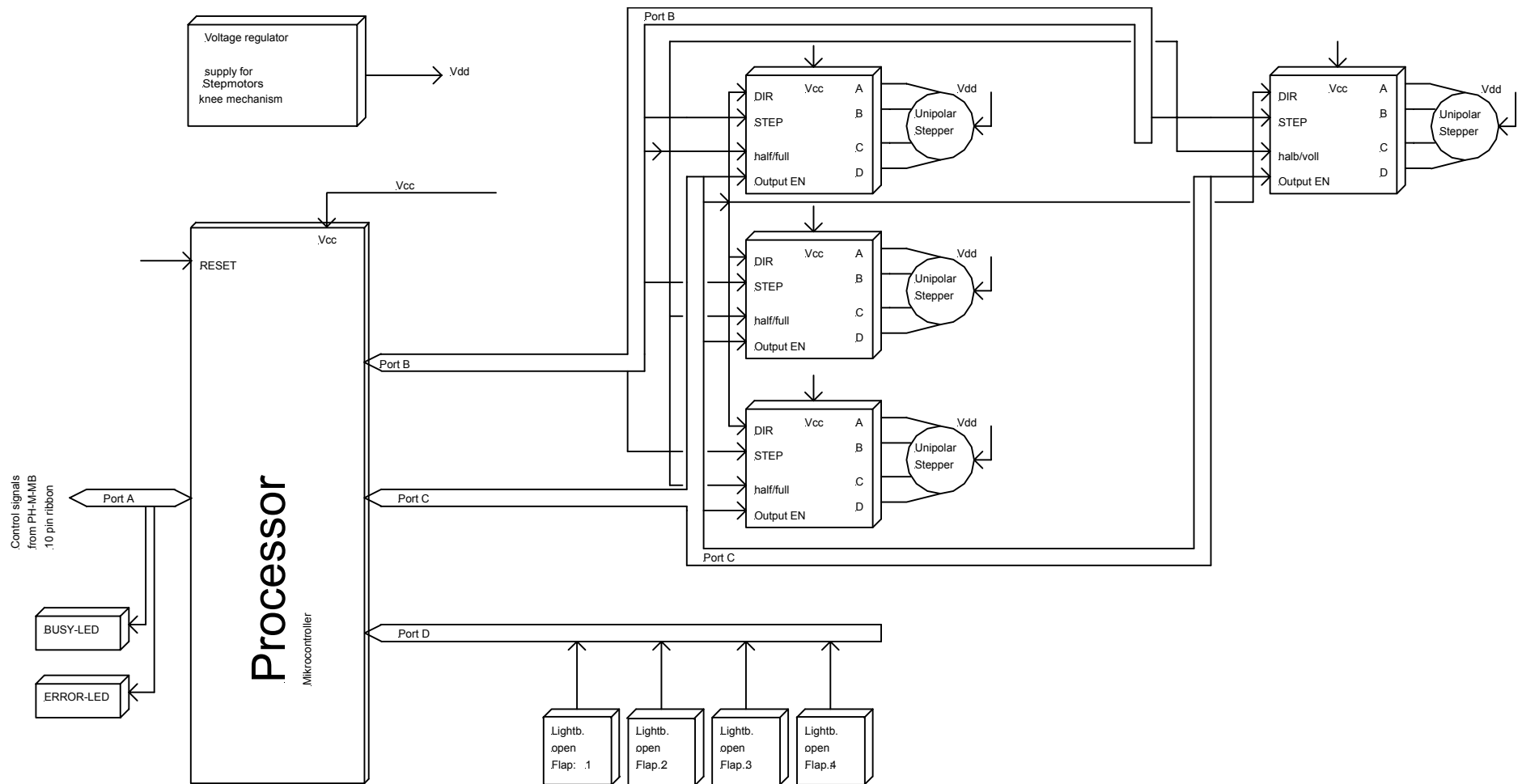


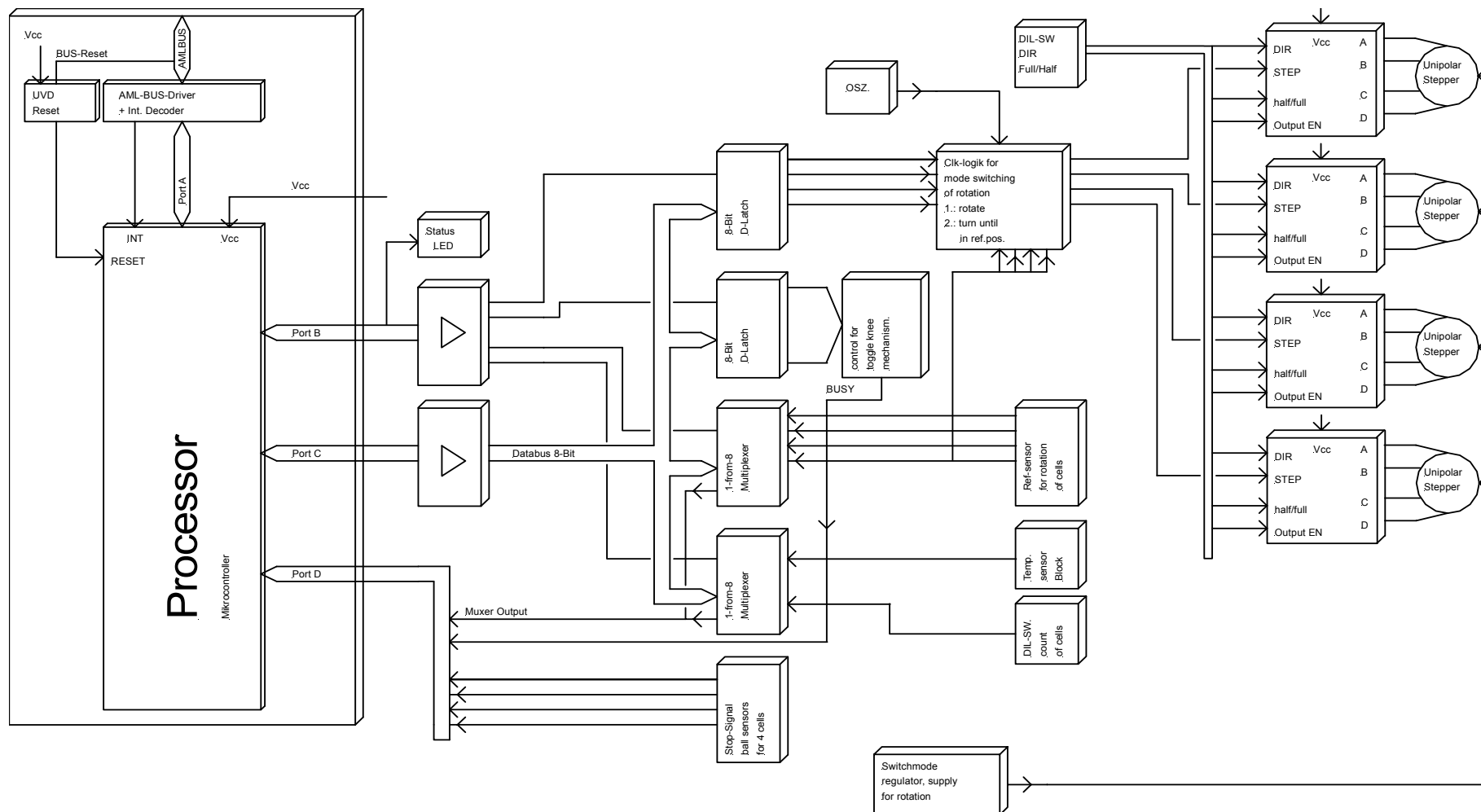


● AMELUNG AMAX CS-190

Drawings / Mechanical Measuring Unit (Knee Joint) Block Diagram

13

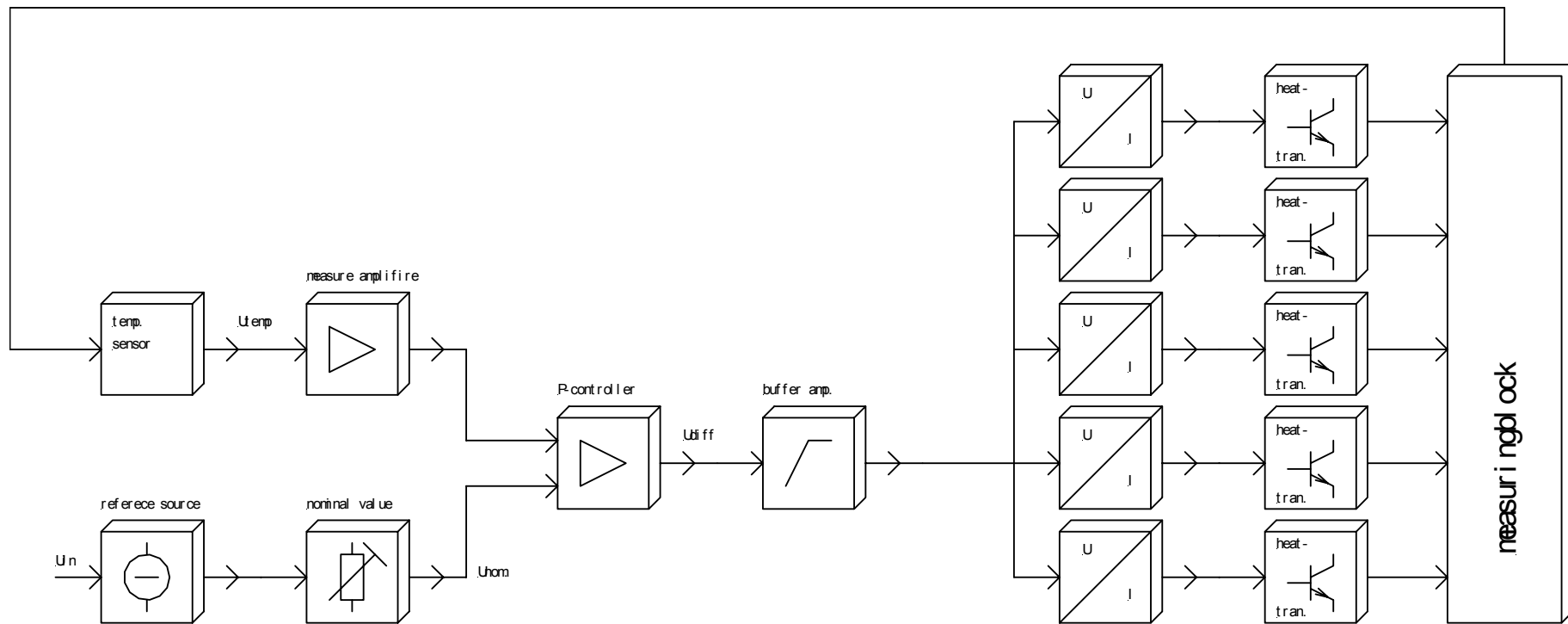




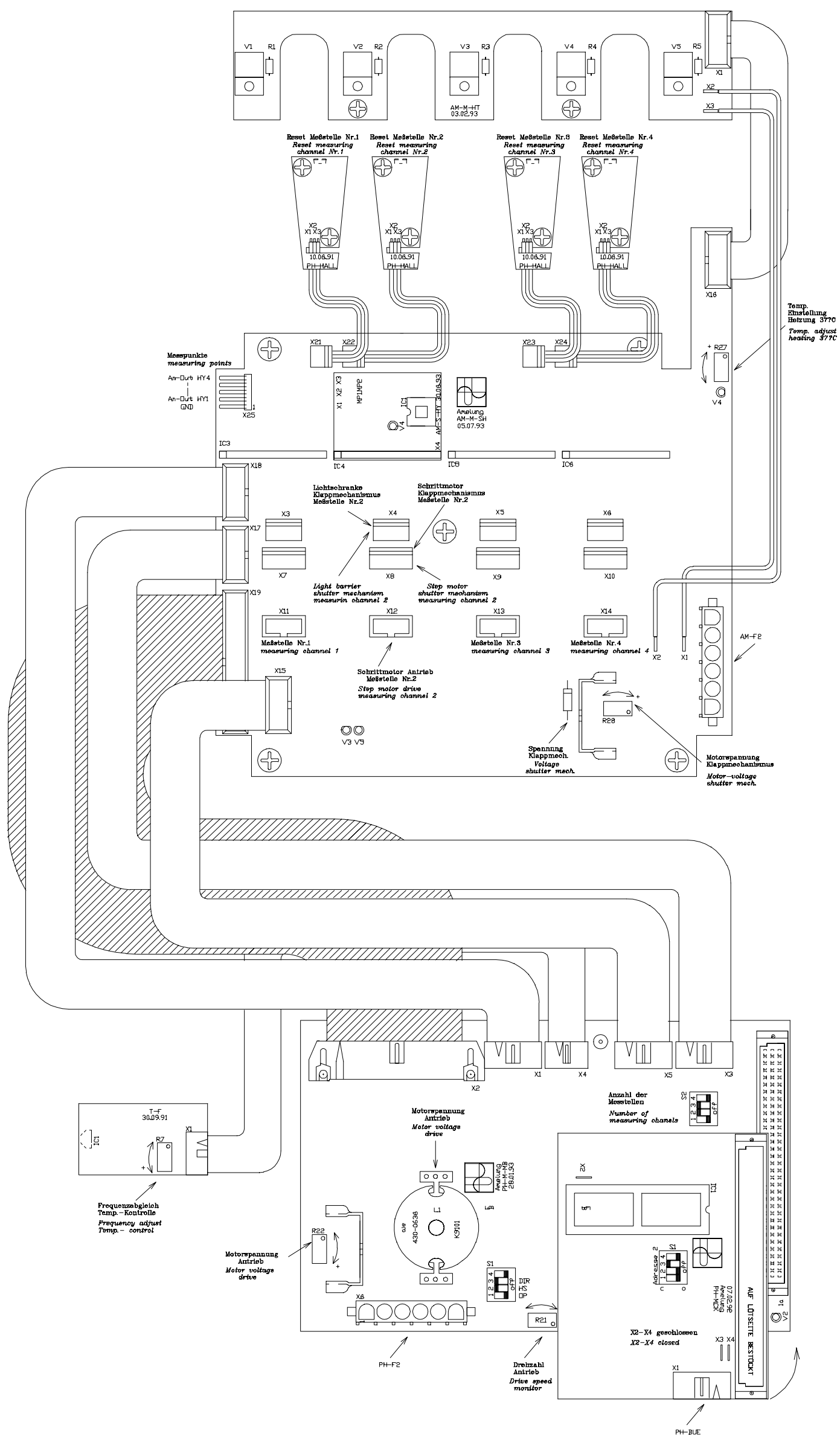
● AMELUNG AMAX CS-190

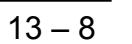
Drawings / Measuring Block Heating Block Diagram

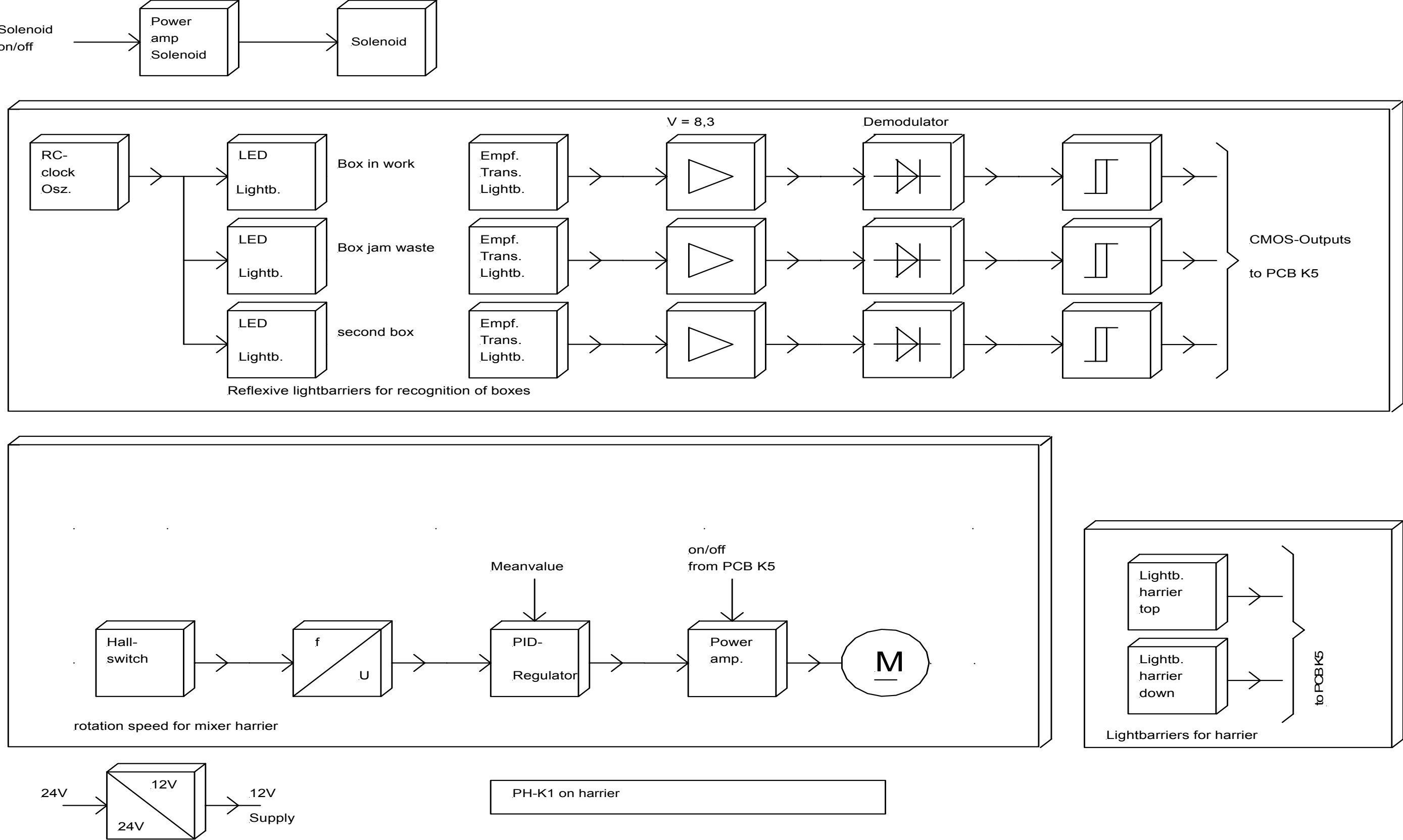
13

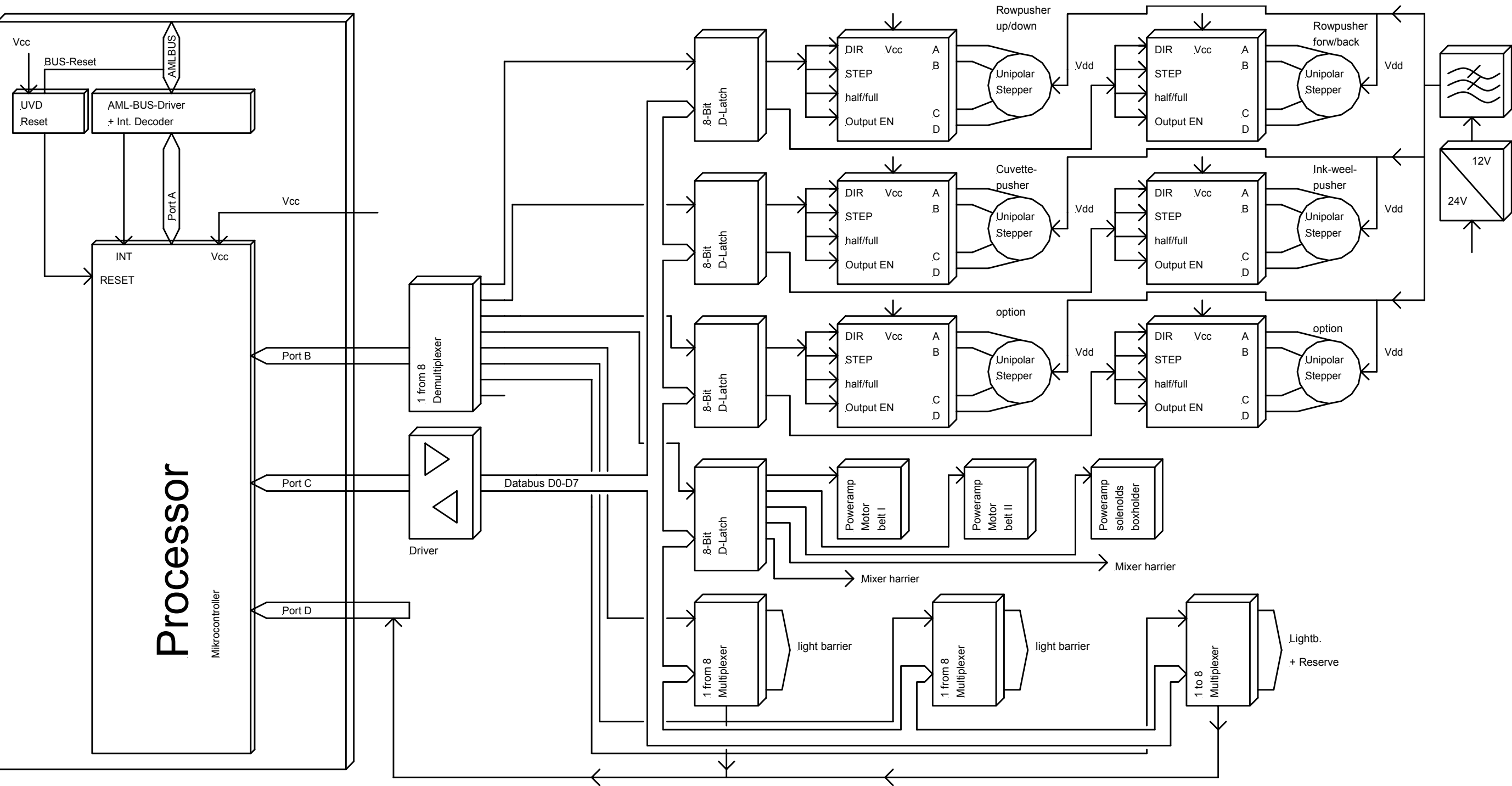


Verdrahtungsplan mechanische Meßstelle Amax Mechanical Measuring Station Circuit Diagramme

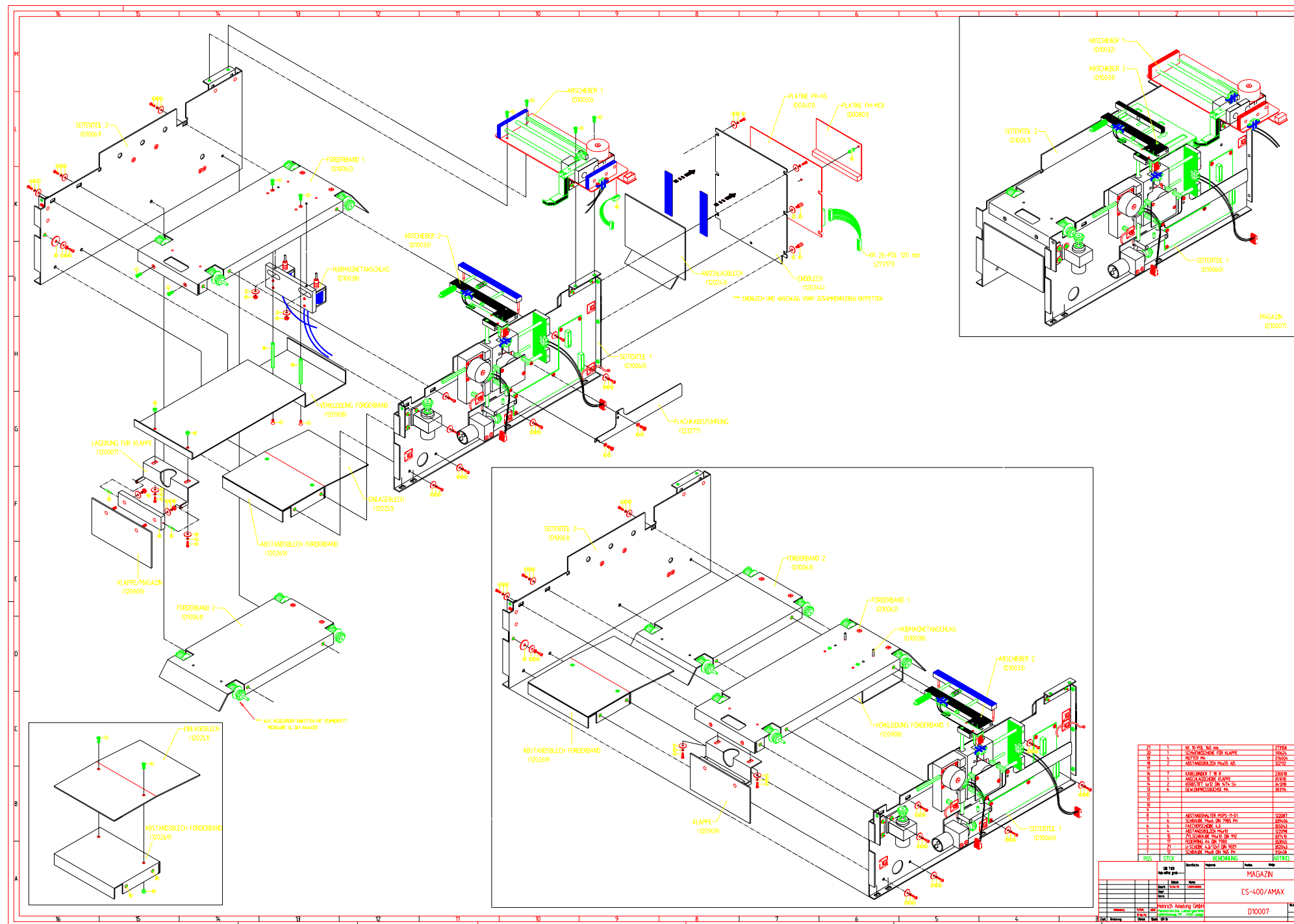


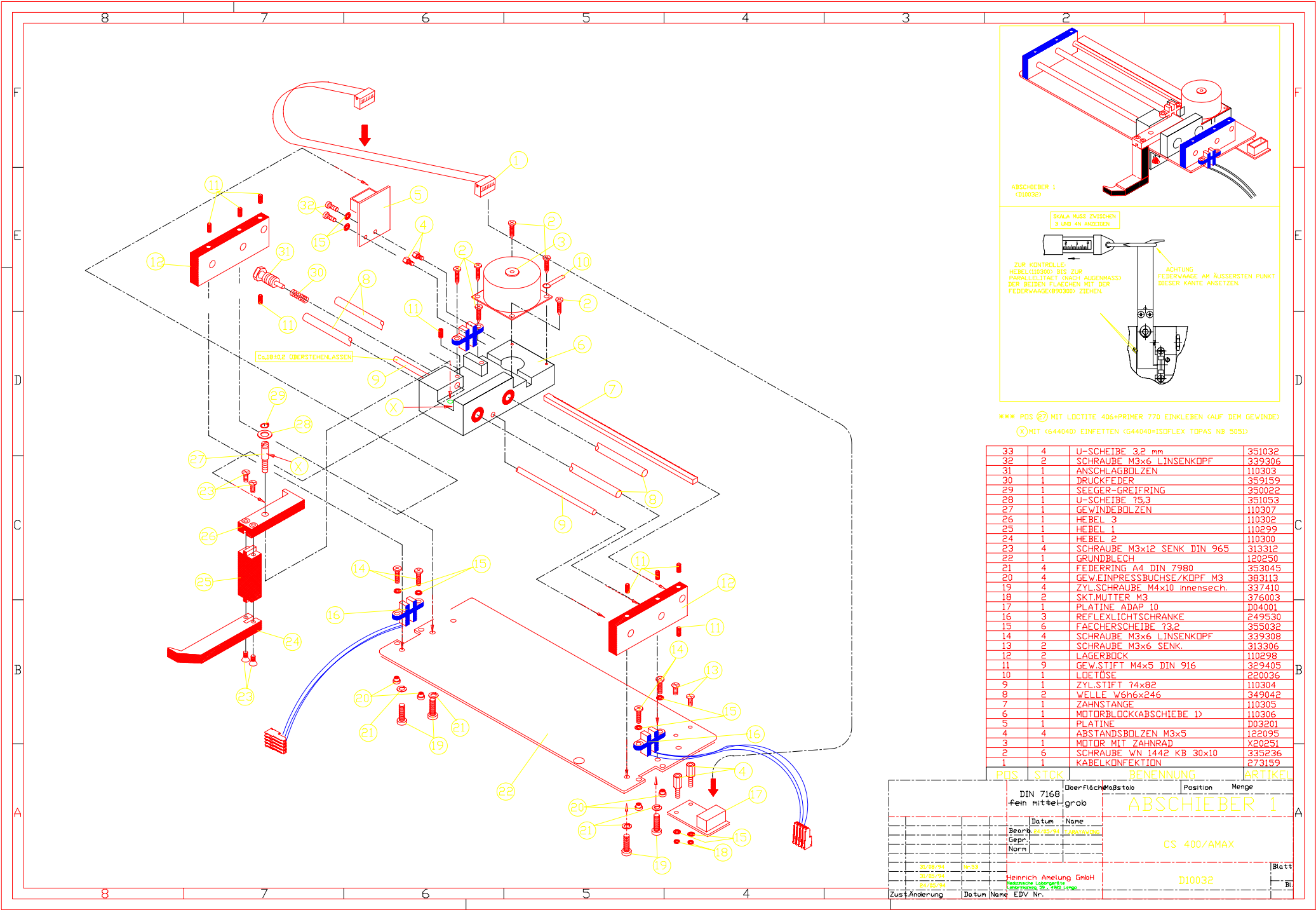


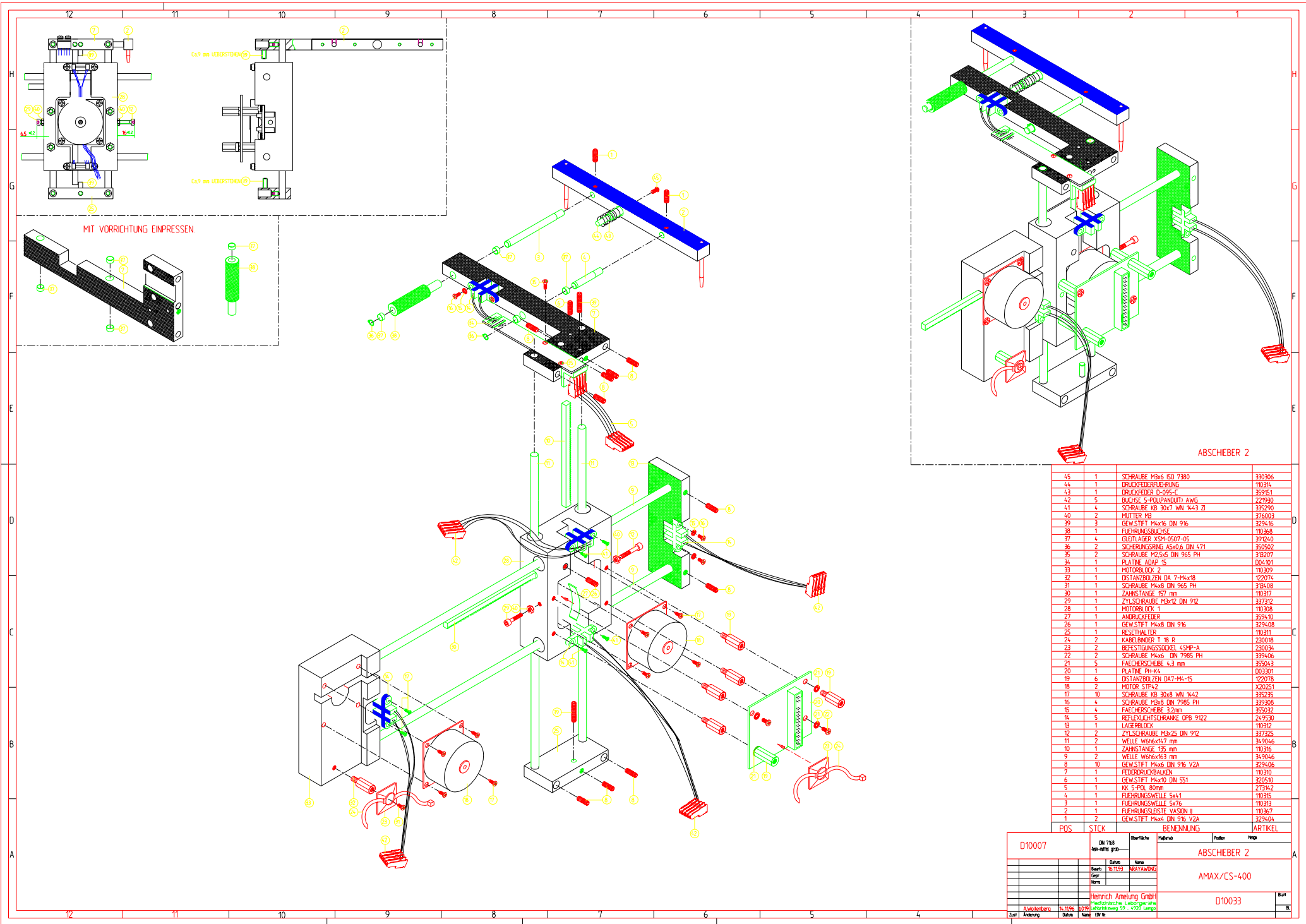


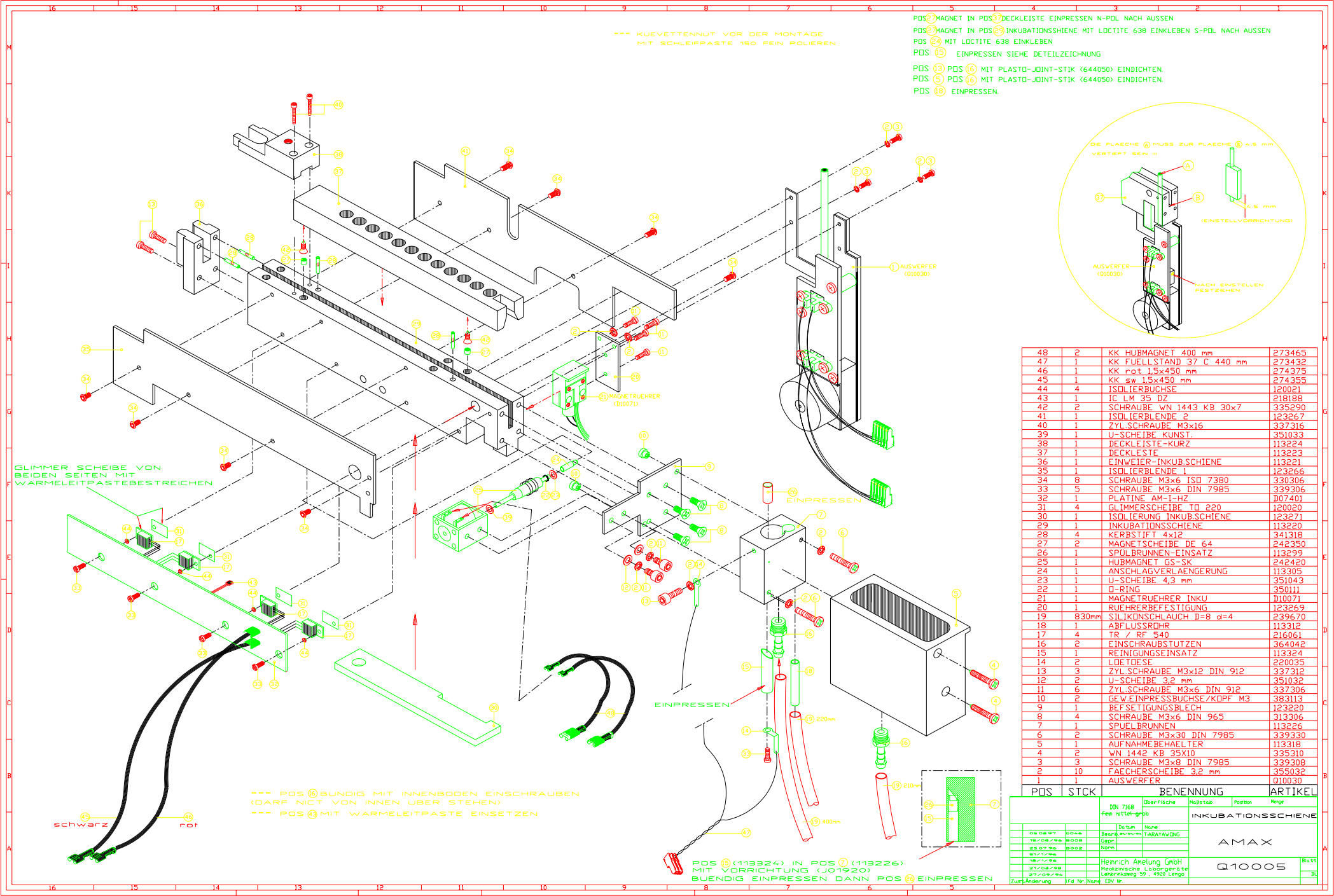


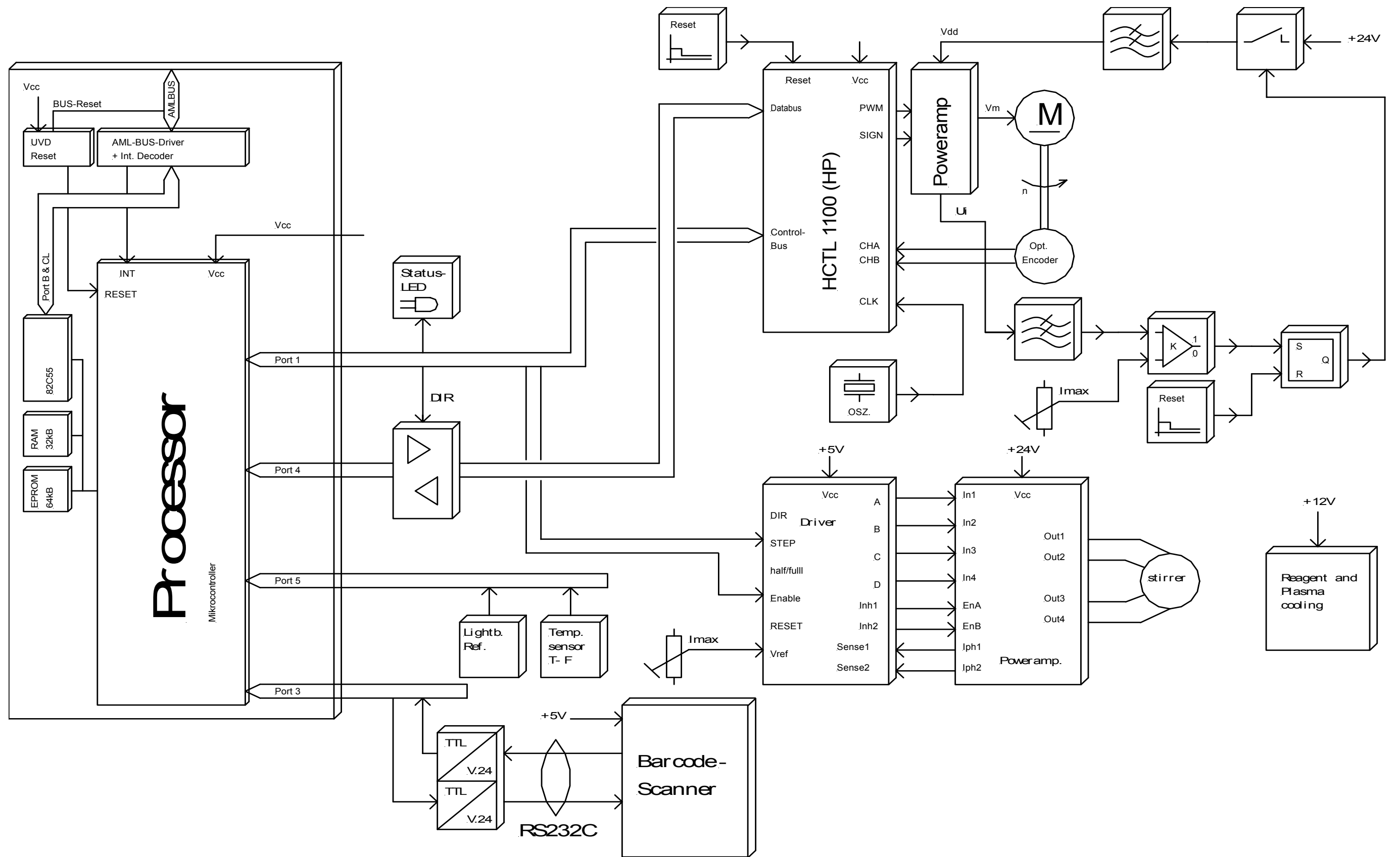


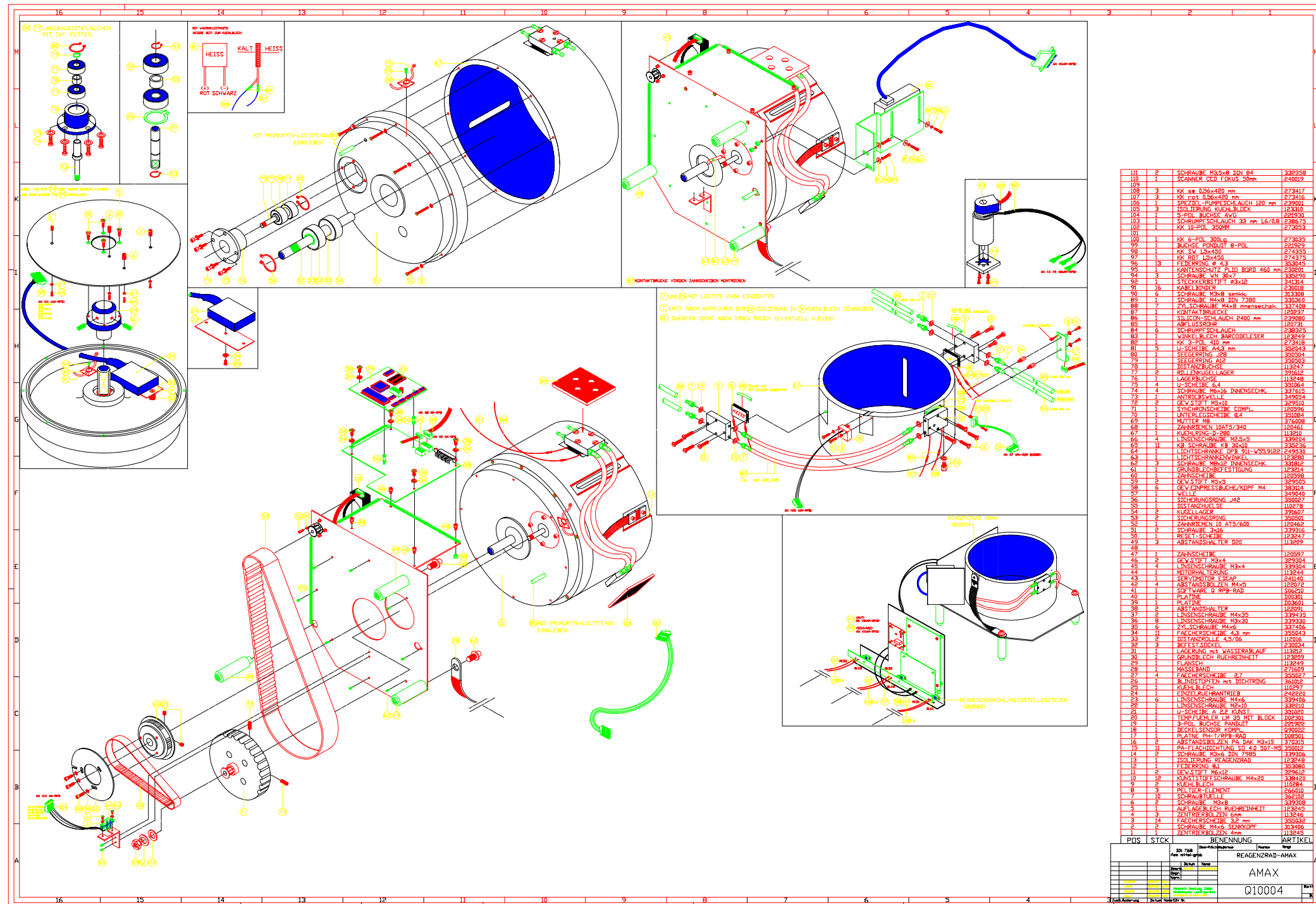








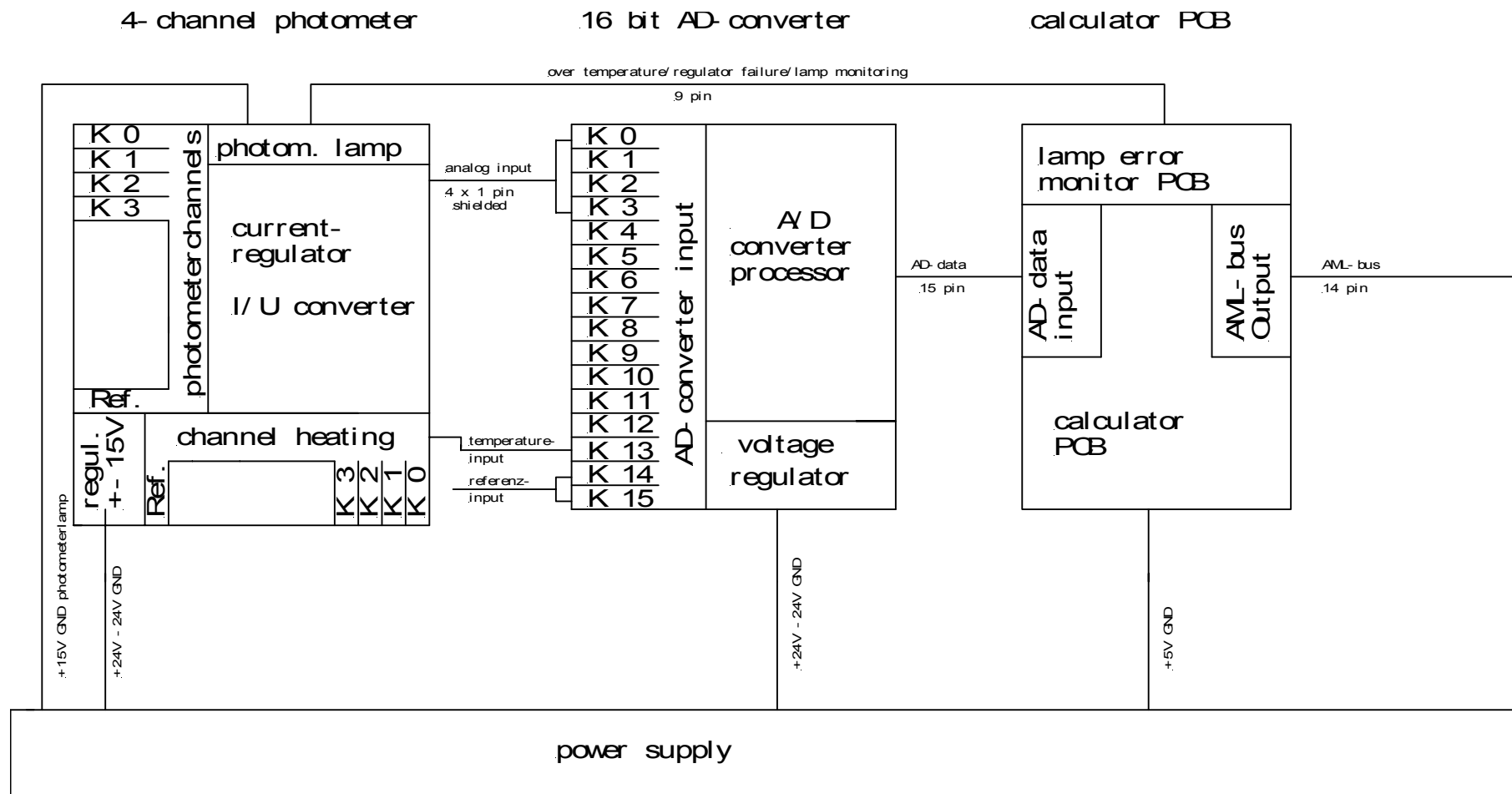




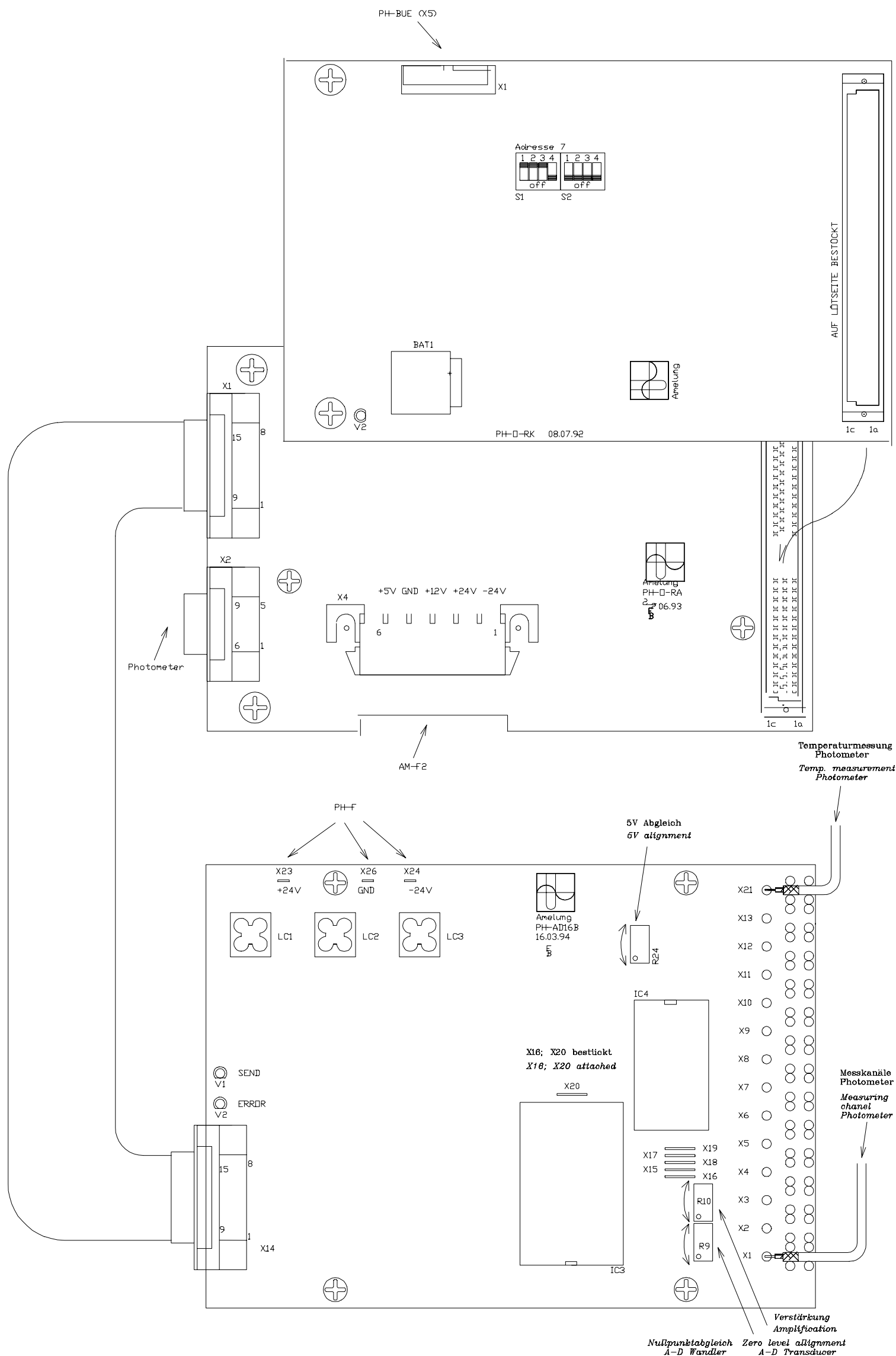
● AMELUNG AMAX CS-190

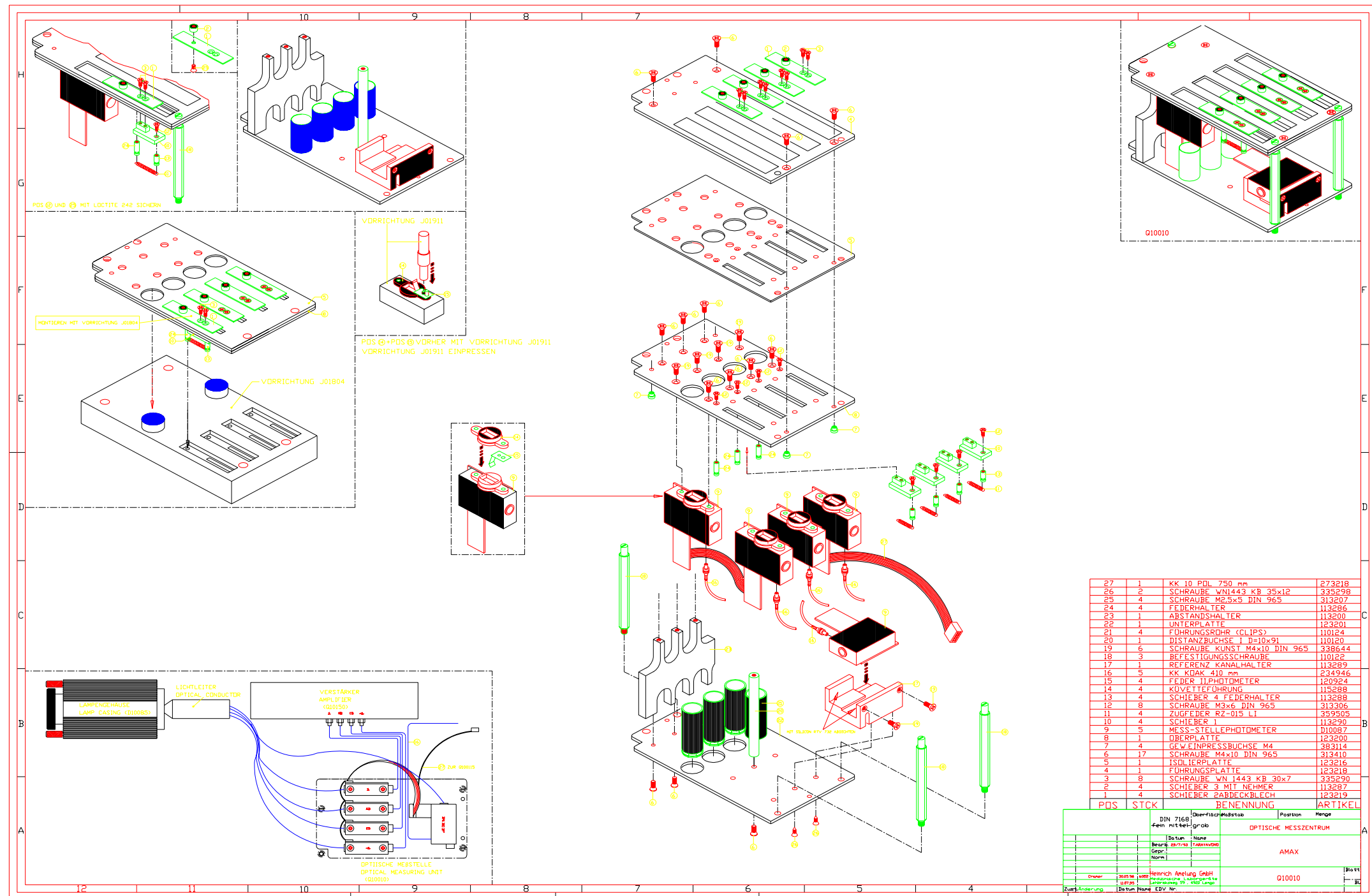
Drawings / Photometer Block Diagram

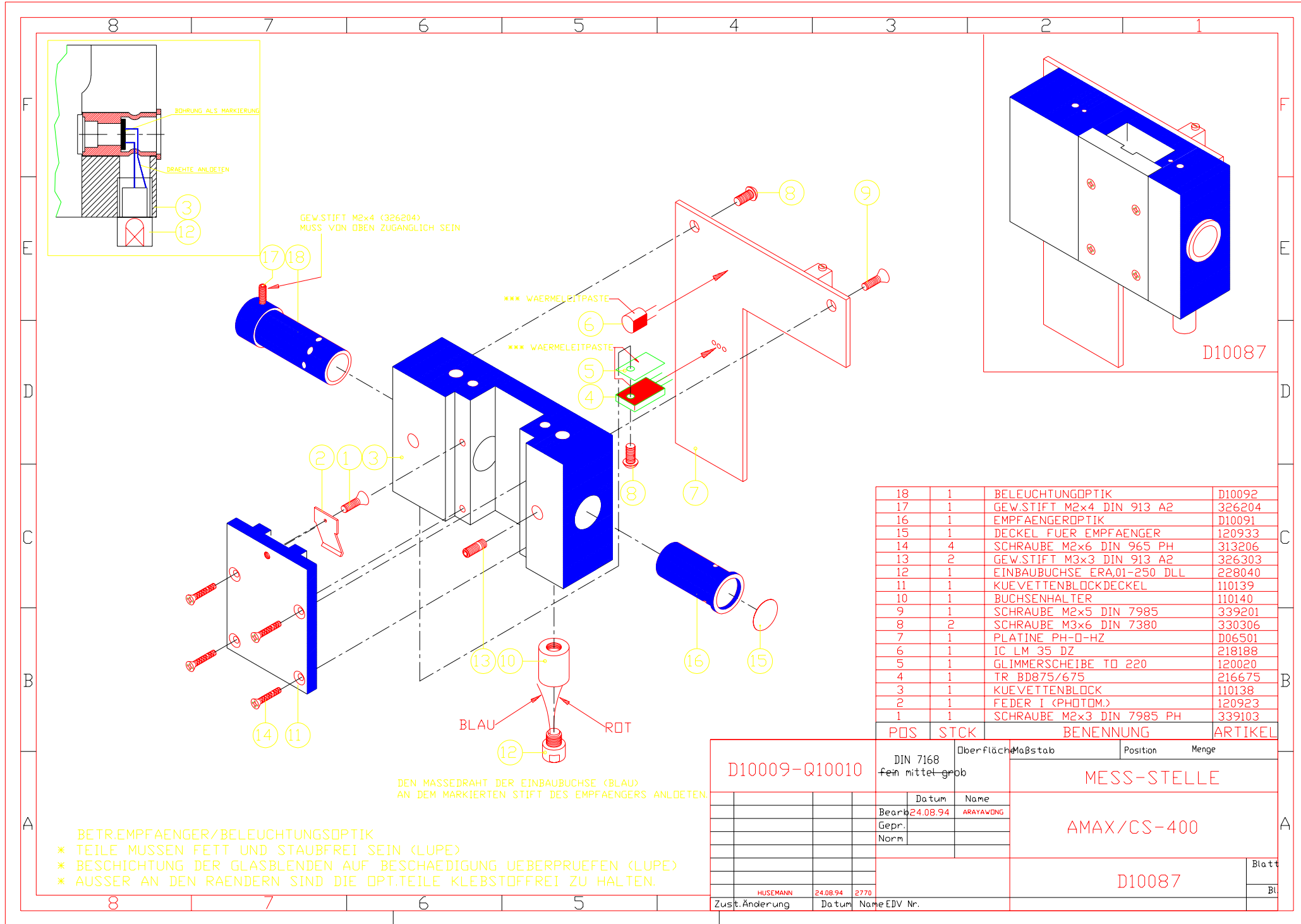
13

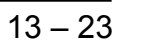


Verdrahtungsplan optische Messeinheit Optical Measuring Unit Circuit Diagramme

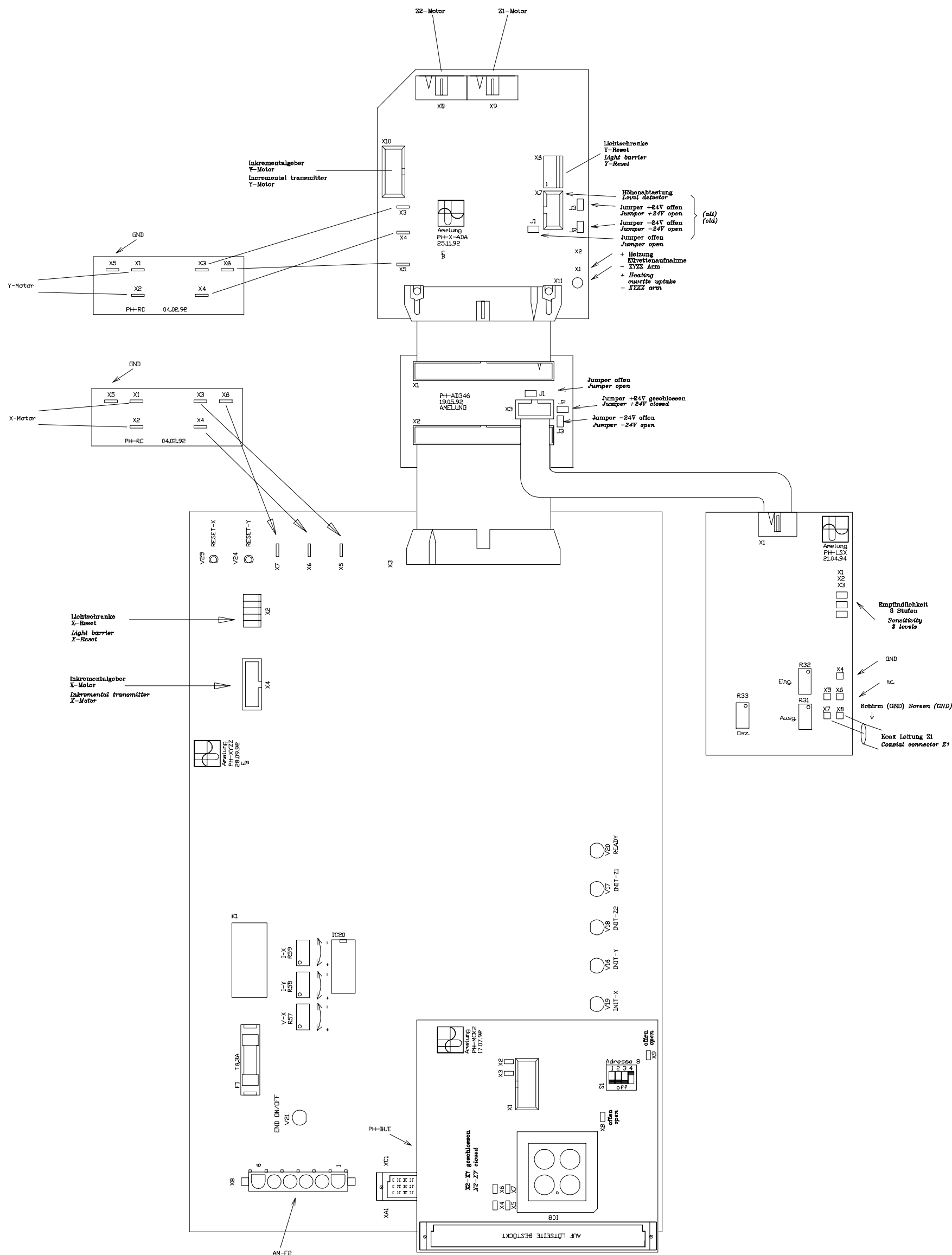


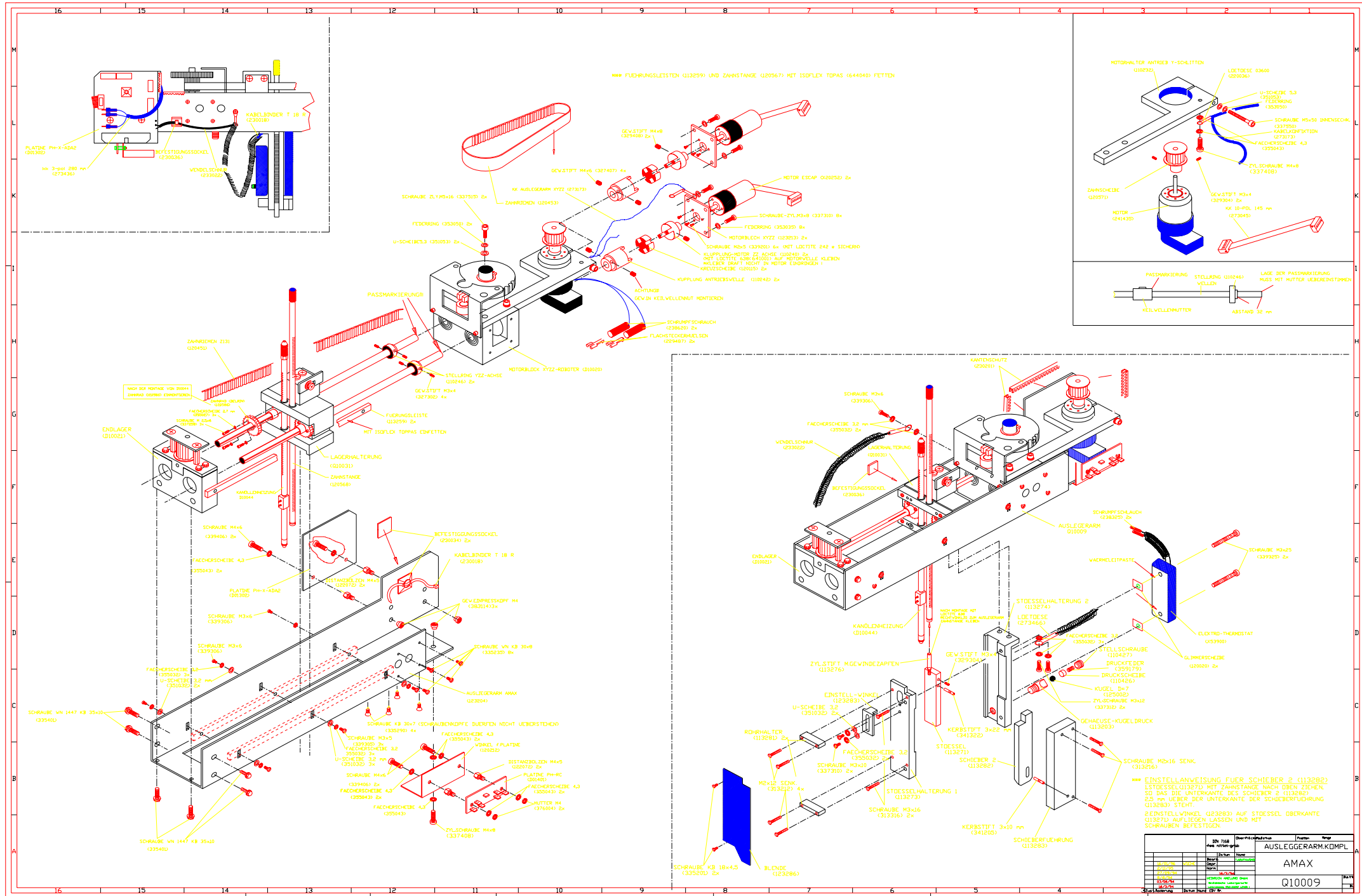


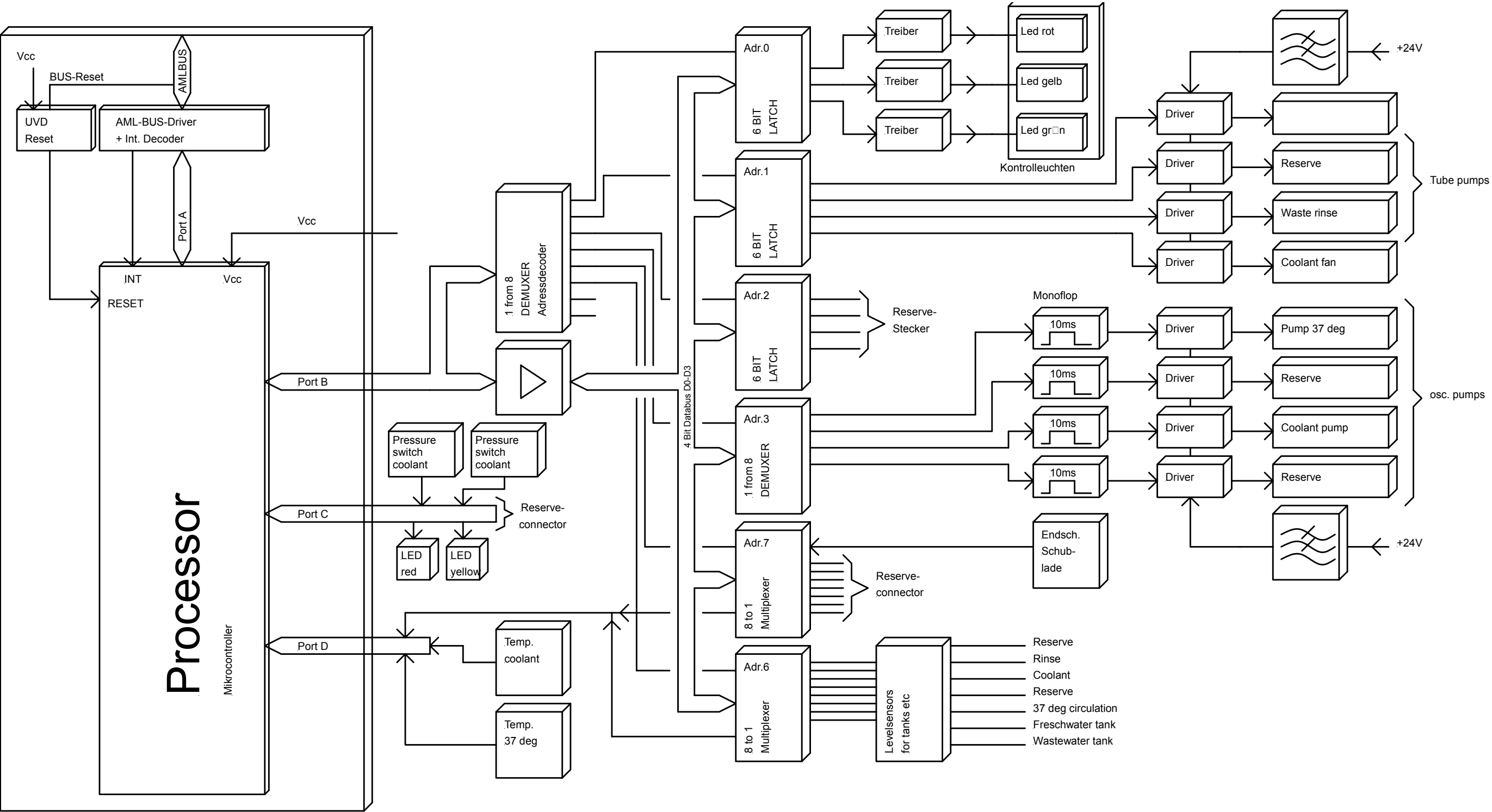




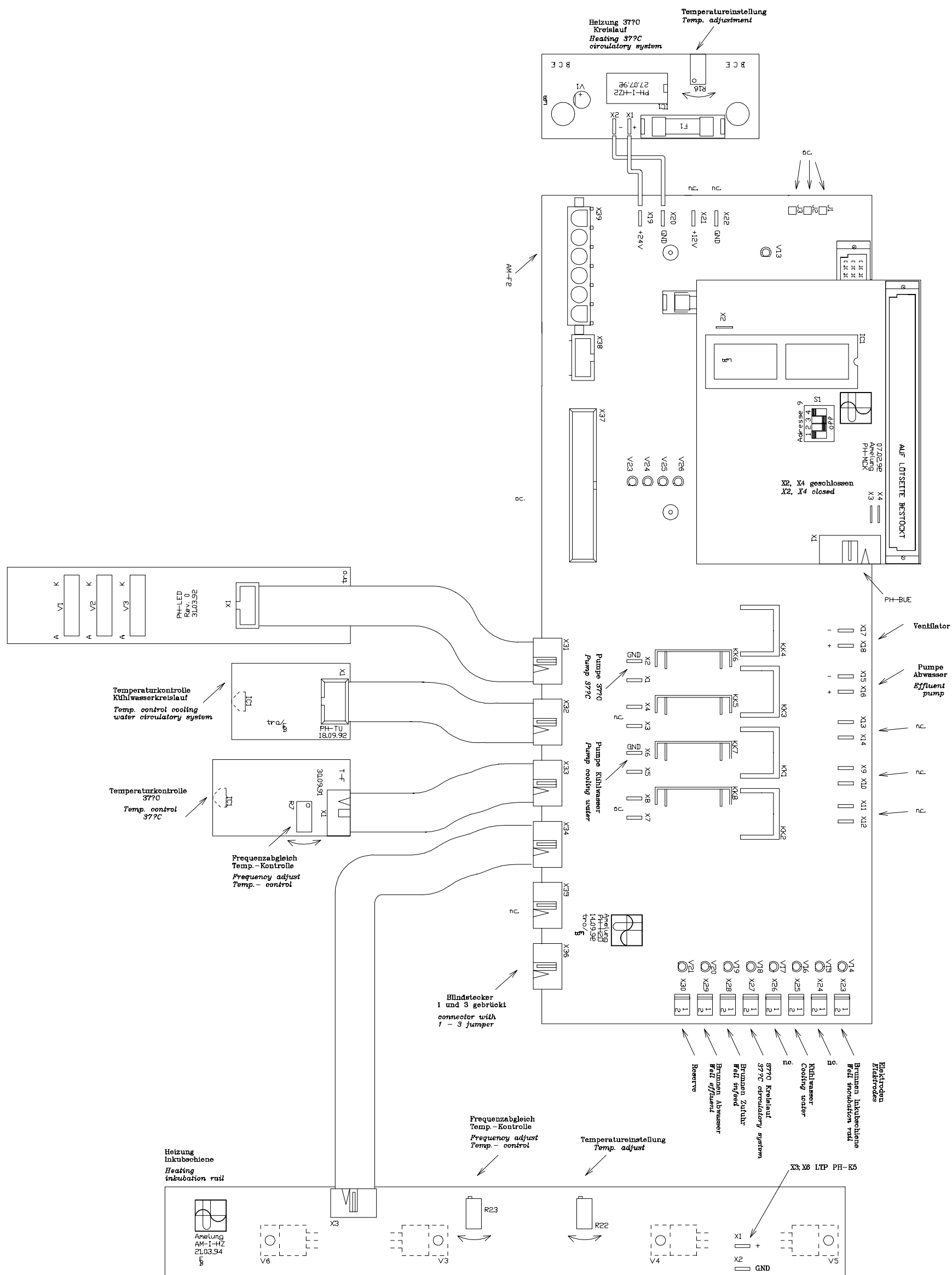
Verdrahtungsplan XYZZ Amax XYZZ Circuit Diagramme Amax

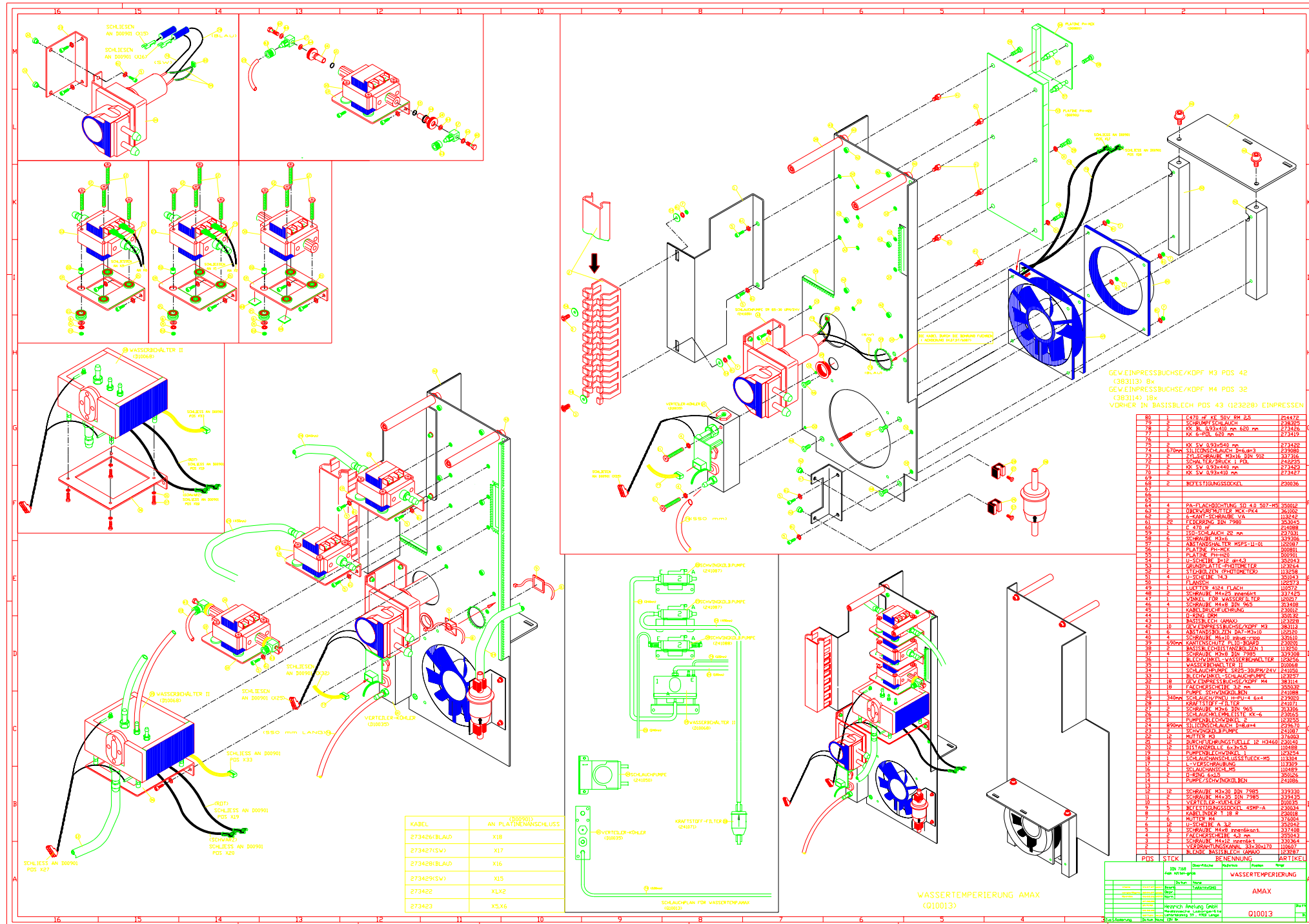


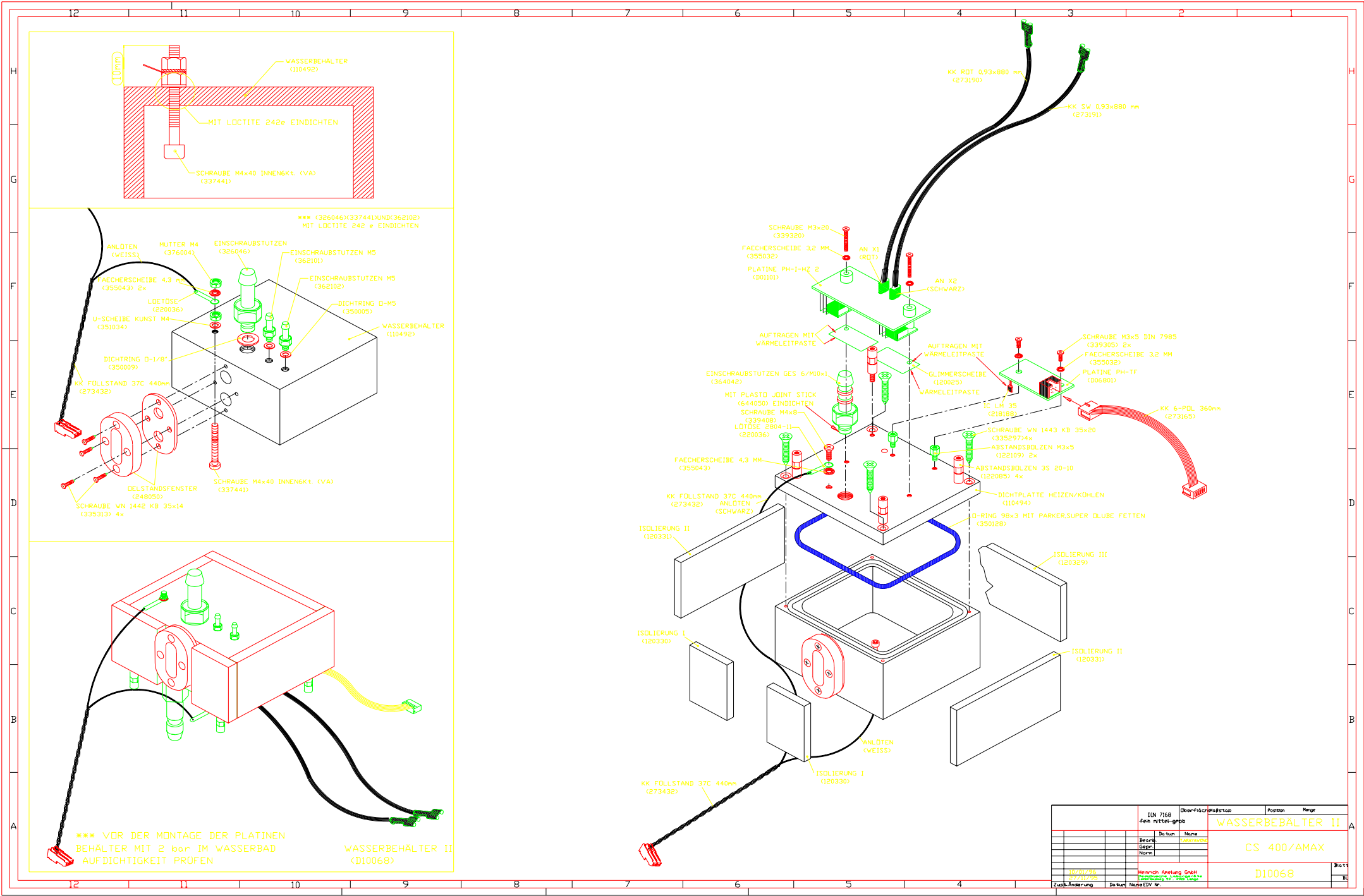


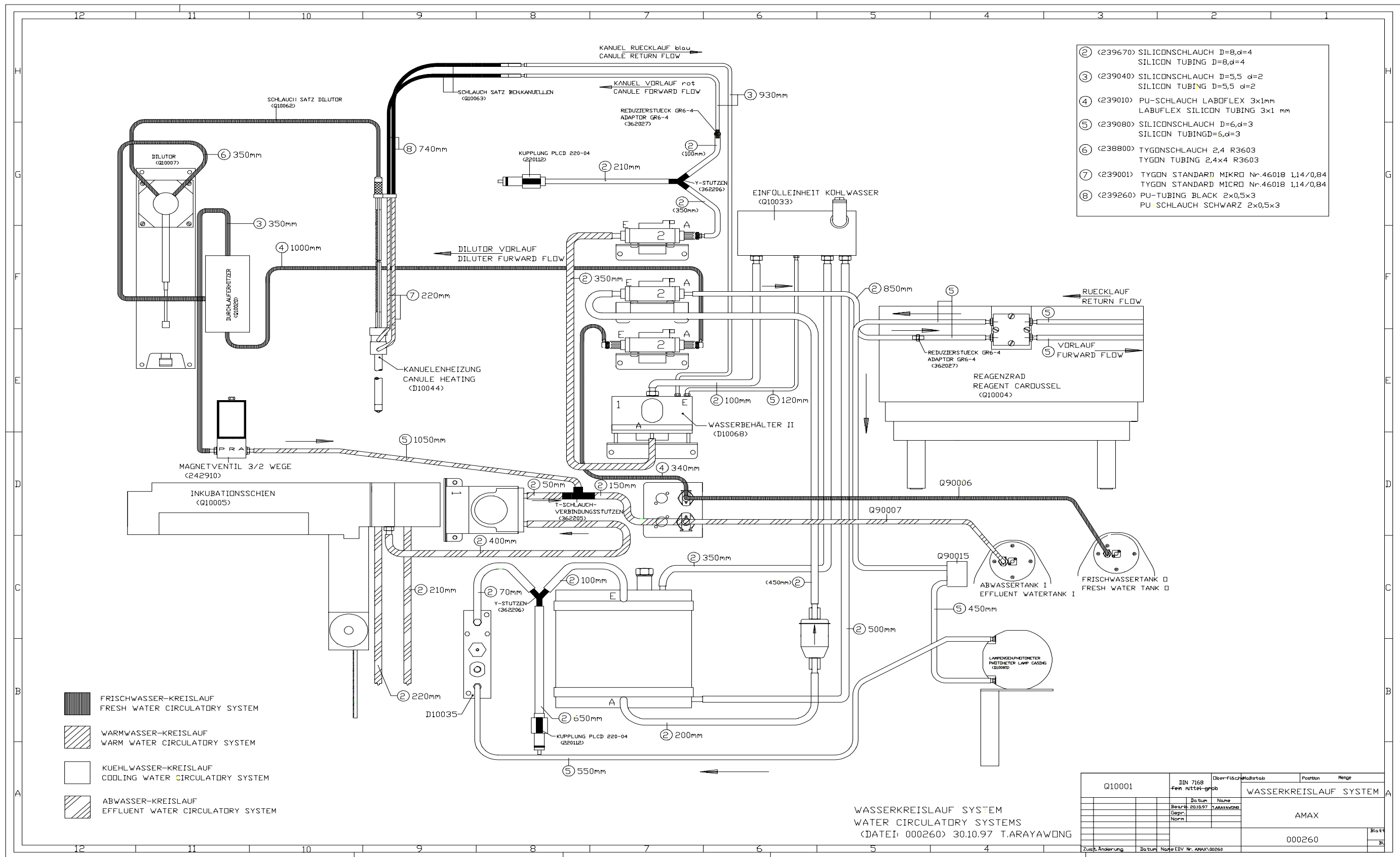


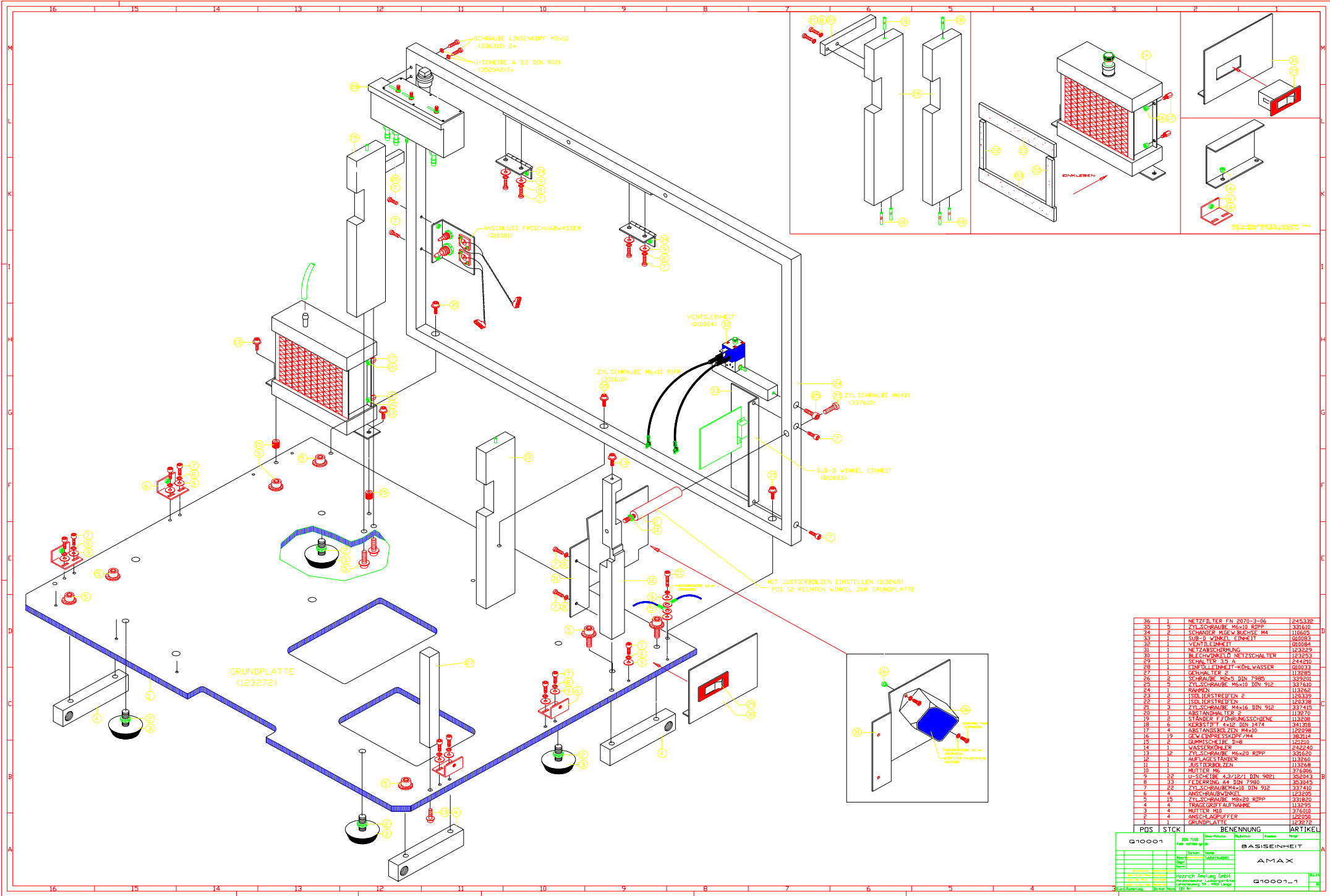
Verdrahtungsplan Wasserkreislauf Amax Water Circulatory System Circuit Diagramme

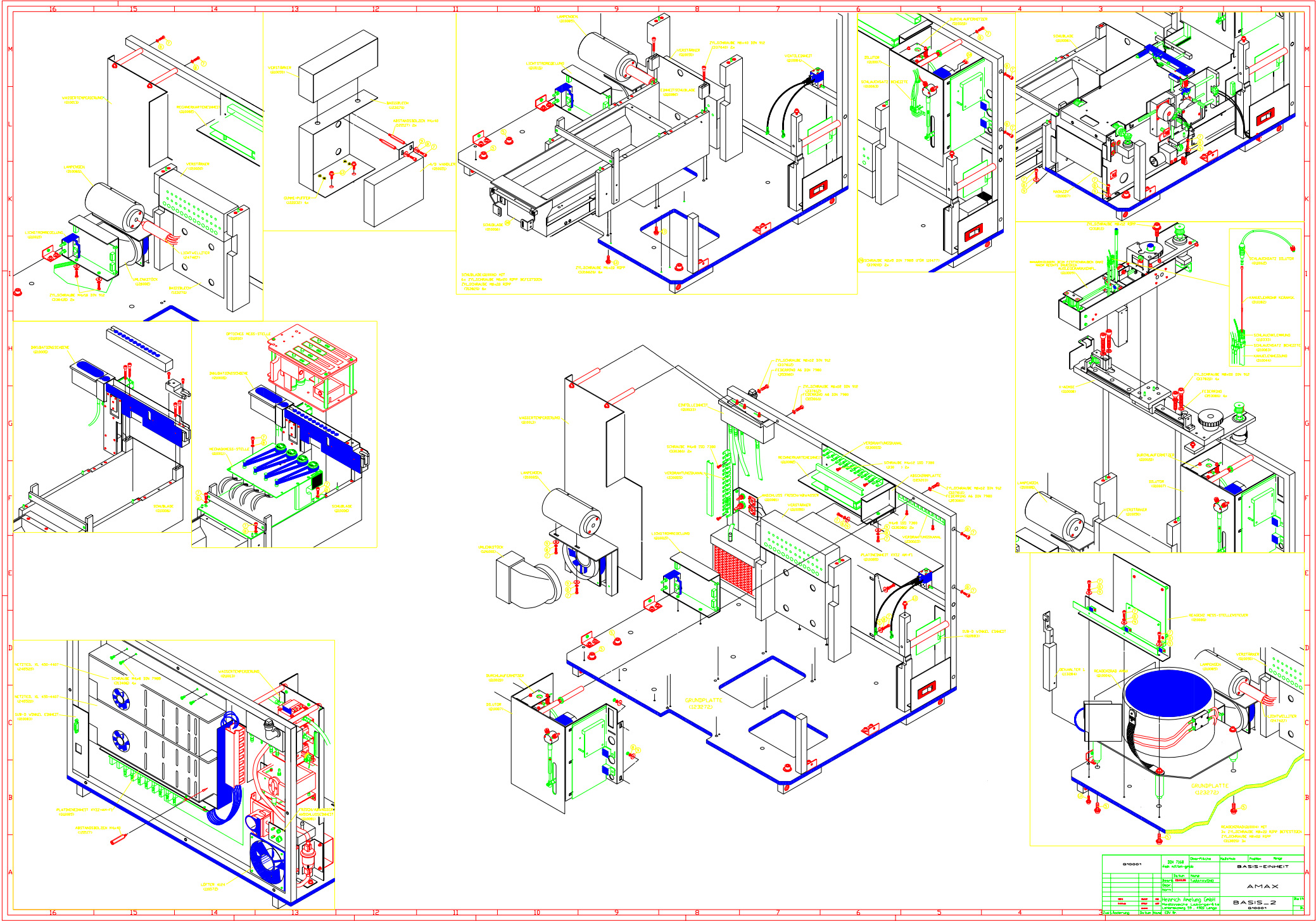


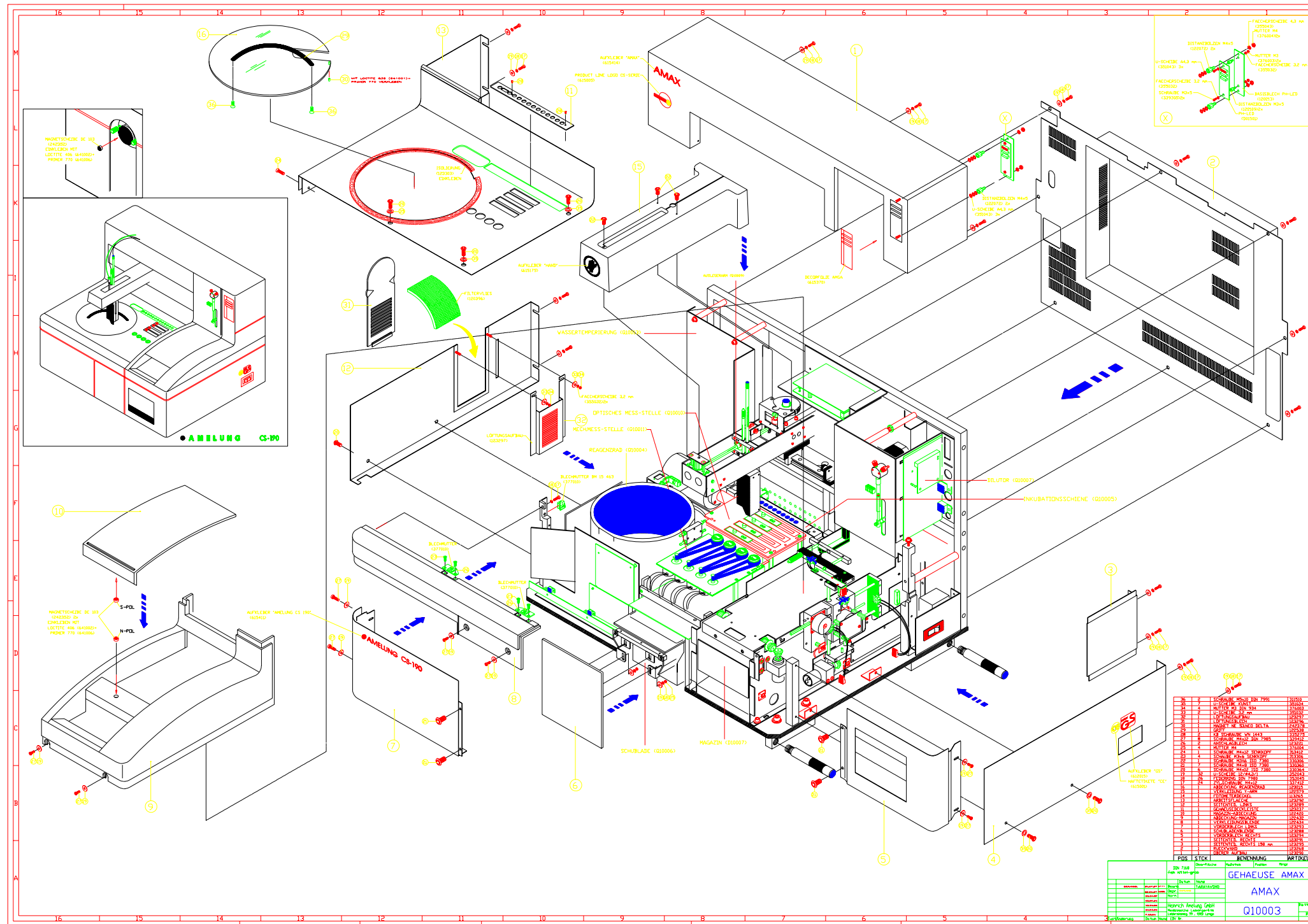












*** POS 17 MIT LOCTITE 406 (641010)
ZWISCHEN PLATINE UND GEHÄUSE KLEBEN

[10] =GRÜN
[11] =SW
[9] =BRAUN
[8] =SW
[7] =VIOLET
[5] =D10085

WAEMELEITPASTE

*** KUEHLBLOCK (POS 15) NACH DER MONTAGE VON POS 13,14,18
MIT 2 bar IM WASSERBAD AUF DICHTIGKEIT PRUEFEN.

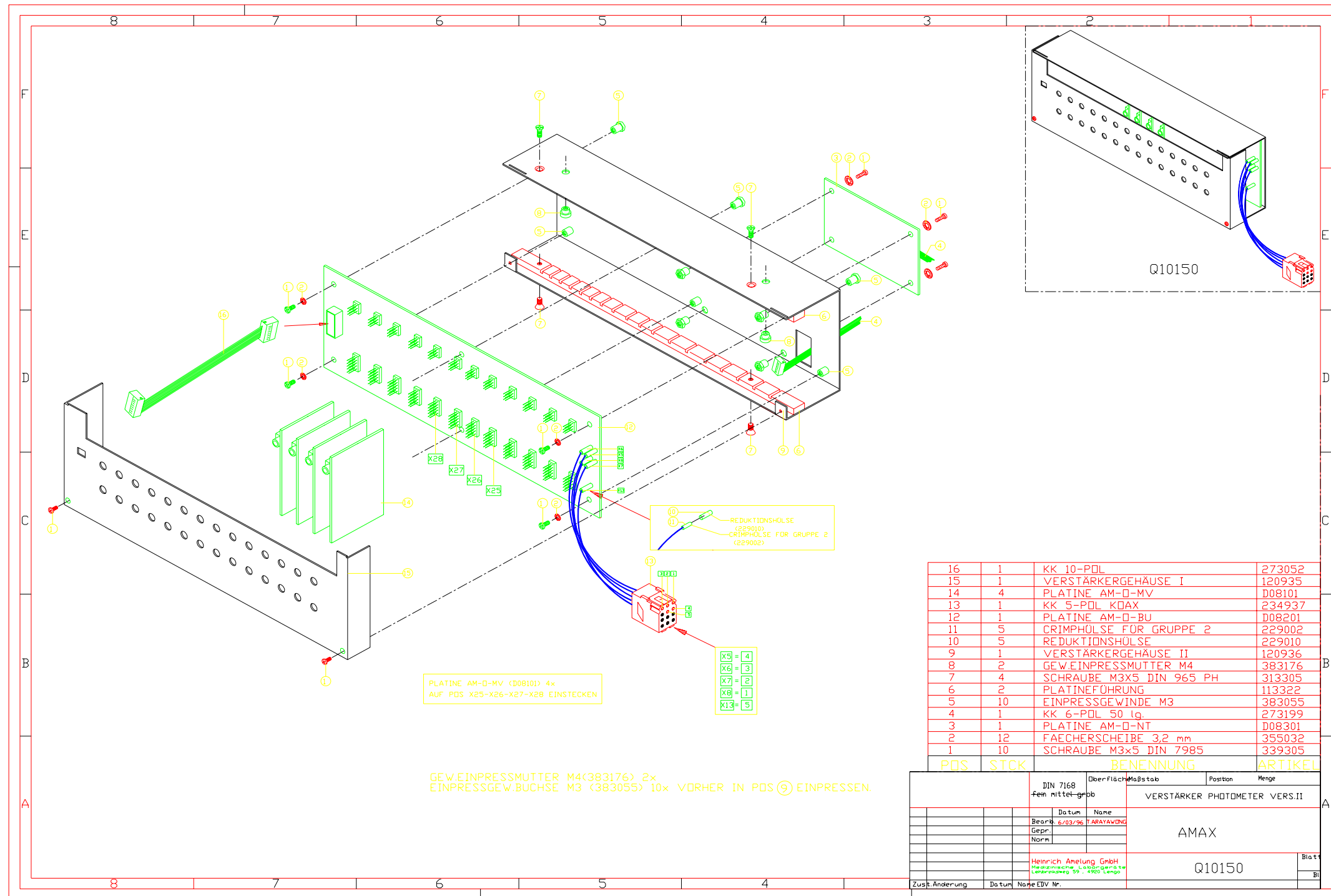
*** POS 18 MIT LOCTITE 638 EINDICHTEN

18	1	GEW.STIFT M5x6 DIN 914	329506
17	1	DISTANZROLLE 4,5x06	112016
16	2	POLYESTERFOLIE 0,1x24 mm	642520
15	1	KUEHLBLOCK	110841
14	1	PA-FLACHDICHTRING M5	350012
13	2	SCHRAUBTUELLE LD 1100-4-M5	362102
12	1	SCHRAUBE M3x12 DIN 7985	339312
11	1	ISOLIERBUCHSE	120021
10	1	TR IRF 540	216061
9	1	GLIMMERSCHEIBE	120020
8	2	SCHRAUBE M3x5	339305
7	1	PLATINE AM-D-LSR	D08401
6	2	ABSTANDSBOLZEN M3x5	122109
5	2	SCHRAUBE M4x10 LINS	339410
4	1	STECKERHALTER	123284
3	1	SCHRAUBE M4x8 SENK	313408
2	2	GEW.EINPRESSBUCHSE/KOPF M4	383114
1	5	FAEHERSCHEIBE 3,2 mm	355032
1	5	MUTTER M3	376003
1	1	HALTER LICHTSTROMREGELUNG	123230

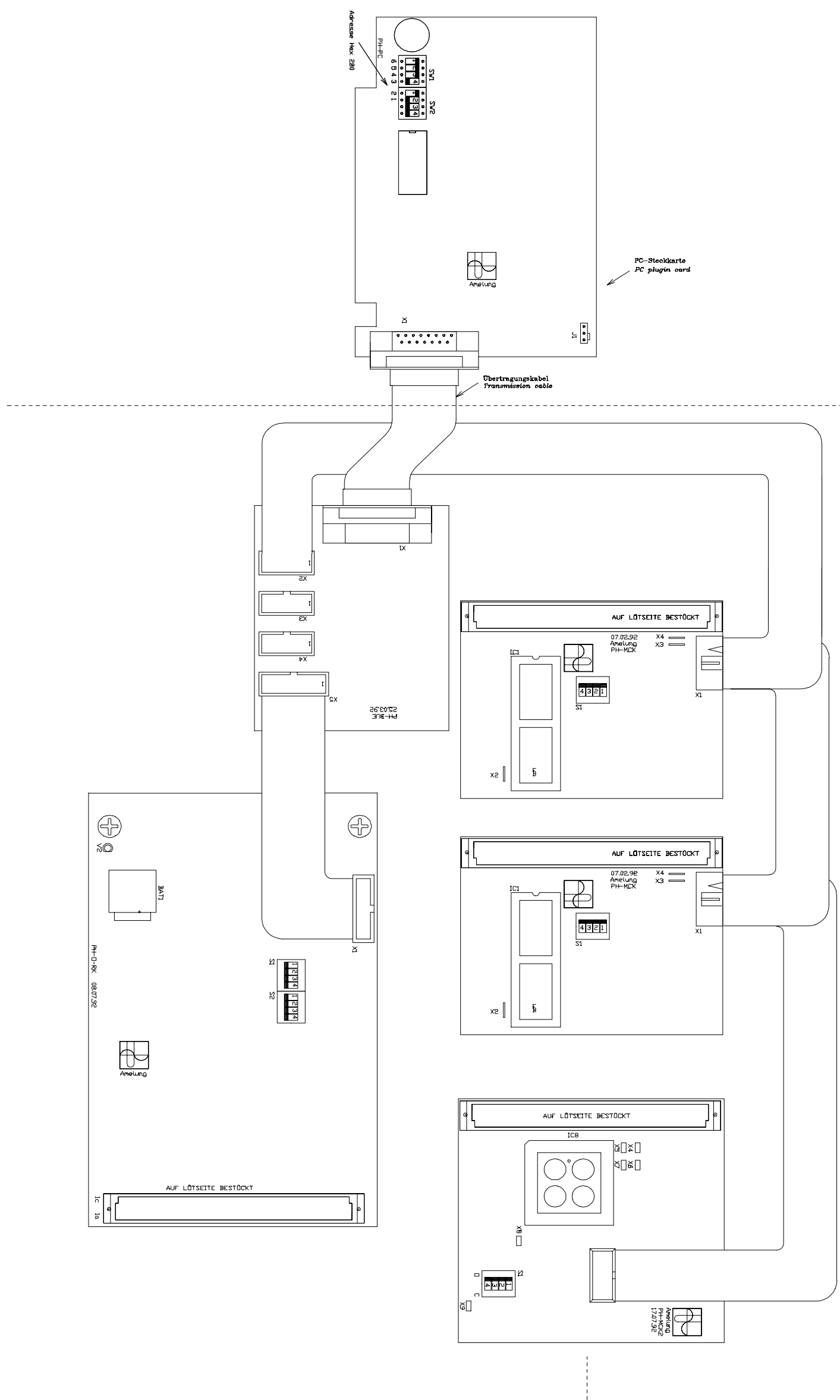
POS	STCK	BENENNUNG	ARTIKEL
		DIN 7168 fein mittel grob	
		Datum Name	
		Bepr. 28/02/96	
		Gepr.	
		Norm	
		Heinrich Amelung GmbH	
		Medizinische Labogeräte	
		Lehrbriksweg 59 / 4920 Lemgo	
		EDV Nr.	

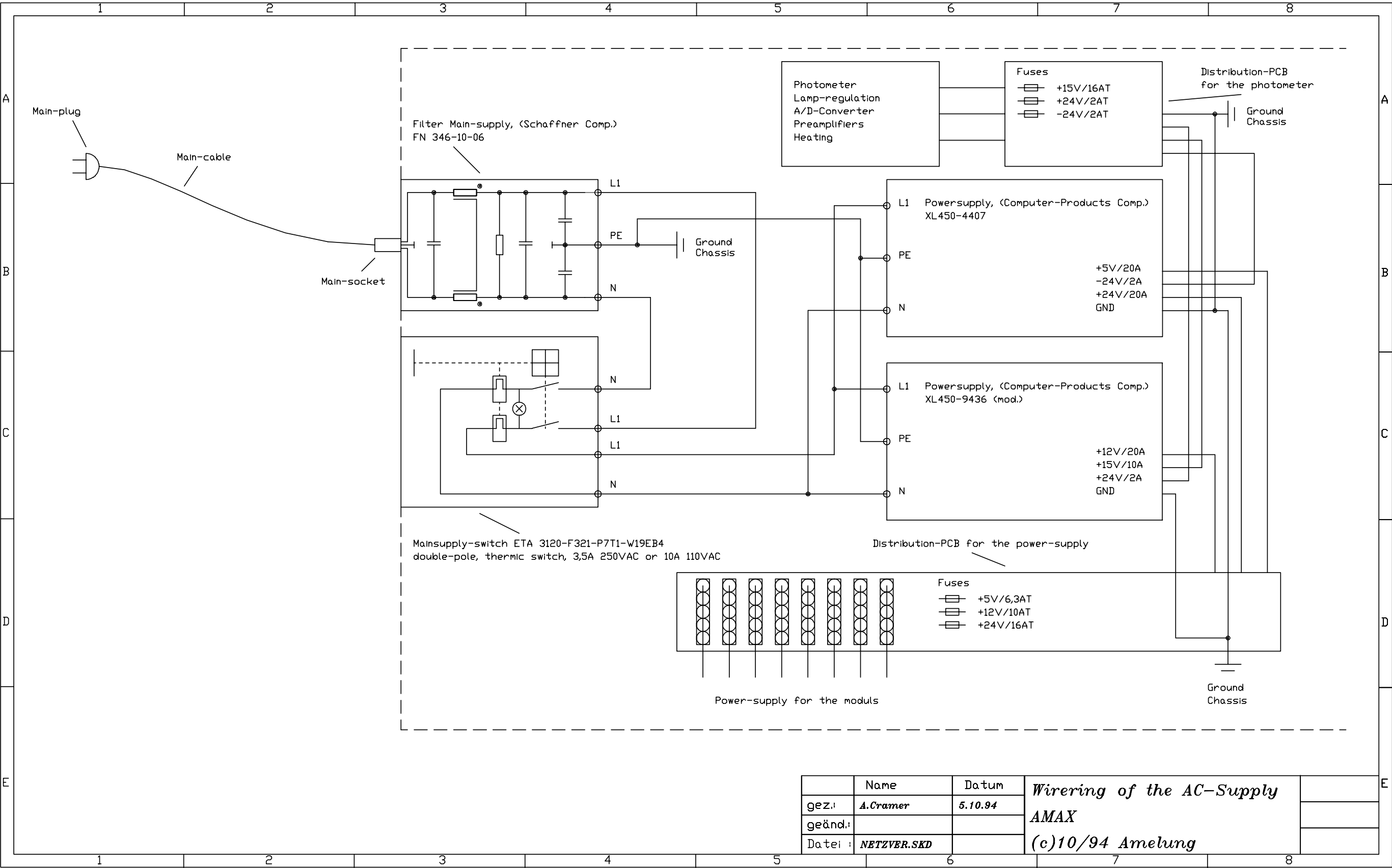
Position	Menge
LICHTSTROMREGELUNG KOMPL.VERS II	
AMAX	
Q10115	

Blatt
11



Verdrahtungsplan PC-AMAX PC-AMAX Circuit Diagramme





● AMELUNG AMAX CS-190

Drawings / Moduls PCB Location

13

Modul XYZZ-Cantilever

- Platine PH-XYZZ (D00101)
- Platine PH-MCK II (D03601)
- Platine PH-AD346 (D01801)
- Platine PH-RC (D01401)
- Platine AM-F2 (D01701)

XYZZ-Cantilever

- Platine PH-X-ADA II (D01302)
- Platine PH-RC (D01401)

Power Supply

- Netzteil (245520)
- Netzteil (245525)

Water Temperature

- Platine PH-H2O (D00901)
- Platine PH-MCK (D00801)
- Platine PH-TU (D02601)
- Platine PH-TF (D06801)
- Platine PH-I-HZ2 (D01101)
- Platine PH-LED (D01501)

Light Current Regulator

- Platine AM-O-LSR (D08301)

Amplifier & AD-Converter

- Platine AM-O-NT (D08301)
- Platine AM-O-BU (D08201)
- Platine AM-O-MV (D08101)
- Platine PH-AD16B (D07001)

Reagent-Plasma-Tray

- Platine AM-RPB (D00301)
- Platine PH-MCK II (D03601)

Reagent Temperature Control

- Platine PH-R2R (D06101)
- Platine PH-M-MB (D05601)
- Platine PH-MCK (D00801)

Incubation Rail

- Platine AM-I-HZ (D07401)

Mechanical Measuring Unit

- Platine AM-M-SH (D06901)
- Platine AM-M-HT (D06301)
- Platine PH-M-MB (D05601)
- Platine PH-HALL (D05201)
- Platine PH-TF (D06801)
- Platine AM-S-HY (D06201)
- LTP DIL (251960)

Dilutor

- Platine AM-DIL (D05701)
- Platine PH-MCK II (D03601)
- Platine PH-F (D05901)
- Platine PH-LSX (D01702)

Photometer

- Platine PH-O-RK (D02501)
- Platine PH-O-RA (D06401)
- Platine PH-O-HZ (D06501)

Magazine

- Platine PH-K5 (D03401)
- Platine PH-MCK (D00801)
- Platine PH-K1 (D03001)
- Platine PH-K2 (D03101)
- Platine PH-K3 (D03201)
- Platine PH-K4 (D03301)
- Platine PH-K-A1 (D04001)
- Platine ADAP15 (D04101)

14. LIS

14.1	Bidi-Protocol	14 – 1
14.1.1	Data Records	14 – 1
14.1.2	Header	14 – 1
14.1.3	Identification	14 – 1
14.1.4	Result /Test Order	14 – 1
14.1.5	ID-Query	14 – 2
14.1.6	Result	14 – 2
14.2	Communication Protocol	14 – 3
14.2.1	Master to Slave	14 – 3
14.2.2	Slave to Master	14 – 4
14.2.3	Command Characters and Symbols	14 – 5
14.2.4	Import	14 – 6
14.2.5	Result Transmission	14 – 8
14.2.6	Export	14 – 9
14.2.7	ID-Query	14 – 11
14.3	Host-Communication	14 – 13
14.3.1	Procedure of Processing Real-Time with Barcode	14 – 14
14.3.2	Master to Slave	14 – 15
14.3.3	Slave to Master	14 – 15
14.3.4	Result Transmission	14 – 16
14.3.5	Import of Requests (AMAX = MASTER)	14 – 17
14.3.6	Export of Results (AMAX = MASTER)	14 – 18

14.1 Bidi-Protocol

14.1.1 Data Records

All data records are type SDF (Space Defined):

14.1.2 Header (Length 16 characters)

FIELD	Data type	Link	Channel Number	Note
RECTYPE	TEXT	left	1	"H"
WSID	TEXT	left	5	instrument ID: "AMAX"
LDATE	TEXT	left	10	Date of the list

14.1.3 Identification (Length 61 characters)

FIELD	Data type	Link	Channel Number	Note
RECTYPE	TEXT	left	1	"I"
ID	TEXT	left	20	ID-Code
NAME	TEXT	left	40	name and surname
DEPT	TEXT	left	20	Ward
NOTE	TEXT	left	40	note

14.1.4 Result / Test Order (Length 65 or 29* characters)

FIELD	Data type	Link	Channel Number	Note
RECTYPE	TEXT	left	1	"D"
ID	TEXT	left	20	Sample ID
REQ	TEXT	left	8	Test-code
RESULT1	FLOAT	right	5	Result 1 *
RESULT2	FLOAT	right	5	Result 2 *
RESULT3	FLOAT	right	5	Result 3 *
RESALPHA	TEXT	left	20	Result (Test 33-48) *
ECODE	TEXT	left	1	Error code *

*: These fields may be deleted

14.1.5 ID-Query (Length 26 characters)

FIELD	Data type	Link	Channel Number	Note
RECTYPE	TEXT	left	1	"Q"
WSID	TEXT	left	5	Instrument ID: "AMAX"
ID	TEXT	left	20	Sample-ID

14.1.6 Result (continuous) (Length 70 characters)

Field	Type	Justified	No. chrs	Comment
RECTYPE	TEXT	left	1	"R"
WSID	TEXT	left	5	Instrument ID "AMAX"
ID	TEXT	left	20	Sample ID
REQ	TEXT	left	8	Test-code
RESULT1	FLOAT	right	5	Result 1
RESULT2	FLOAT	right	5	Result 2
RESULT3	FLOAT	right	5	Result 3
RESALPHA	TEXT	left	20	Result (Test 33 - 48)
ECODE	TEXT	left	1	Error code

14.2 Communication Protocol

The following communication protocol is used for both data transmission directions.
According to the configuration the CS-190 assumes the function MASTER or SLAVE:

14.2.1 MASTER to SLAVE

Tab. 14.2.1.1

MASTER	SLAVE	Comment
<DLE>		Start communication process
<TC>	<ACK> <TC>	ready
<STX>		
Text ("H.....")		Header is transmitted
<ETX>		
<CHKS>		
<TC>		
	<ACK>	Data checked and OK
	<TC>	
	<NACK>	Error
	<TC>	
(Record is sent again)		
<STX>		
Text ("I.....")		Sample -ID record
<ETX>		
<CHKS>		
<TC>		
	<ACK>	Data checked and OK
	<TC>	
	<NACK>	Error
	<TC>	
(Record is sent again)		
<STX>		
Text ("D.....")		Test order or result record
<ETX>		
<CHKS>		
<TC>		
	<ACK>	Data checked and OK
	<TC>	
	<NACK>	Error
	<TC>	
(Record is sent again)		
"		
"		
<EOT>		End of transmission
<TC>		

14.2.2 SLAVE to MASTER

Tab. 14.2.2.1

SLAVE	MASTER	Comment
	<ENQ>	Start of communication
	<TC>	
<EOT>		No data available
<TC>		
<STX>		
Text ("H.....")		Header is sent
<ETX>		
<CHKS>		
<TC>		
	<ACK>	Data checked and OK
	<TC>	
	<NACK>	Error
	<TC>	
(Record is sent again)		
	<ENQ>	Request next data string
	<TC>	
<STX>		
Text ("I.....")		Sample-ID record
<ETX>		
<CHKS>		
<TC>		
	<ACK>	Data checked and OK
	<TC>	
	<NACK>	Error
	<TC>	
(Record is sent again)		
	<ENQ>	Request next data string
	<TC>	
<STX>		
Text ("D.....")		Test order or result record
<ETX>		
<CHKS>		
<TC>		
	<ACK>	Data checked and OK
	<TC>	
	<NACK>	Error
	<TC>	
(Record is sent again)		
	<ENQ>	Request next record
	<TC>	
<EOT>		No more data available
<TC>		

14.2.3 Command Characters and Symbols

<DLE>	ASCII code 10h
<STX>	ASCII code 02h
<ETX>	ASCII code 03h
<ACK>	ASCII code 06h
<NACK>	ASCII code 15h
<EOT>	ASCII code 04h
<ENQ>	ASCII code 05h
<CHKS>	Checksum (2 ASCII characters). The checksum is calculated summing the ASCII codes of all characters between <STX> and <ETX>. The module 256 of the sum is converted to its hexadecimal presentation.
<TC>	Consists of up to two user definable character strings. (See host parameters)

Timeout

Each data transfer must be acknowledged within 10 sec. Failing to do so will cause the protocol to be aborted.

Repeat after <NACK>

Data strings refused with a <NACK> will be resent up to three times. After resending the third time the protocol will be aborted.

14.2.4 Import (download request orders from LIS to AMAX)

Example (AMAX configured as MASTER):

AMAX: ENQ TC

LIS: STX | H | AMAX1 | TT/MM/YYYY | ETX Checksum TC

	5	10
--	---	----

AMAX: ACK TC

AMAX: ENQ TC

LIS: STX | I | 11111111 |

	20
--	----

INSTANCE NAME
40

LOCATION
20

Comment
40

 ETX Checksum TC

AMAX: ACK TC

AMAX: ENQ TC

LIS: STX | D | 11111111 | PT | ETX Checksum TC

	20	8
--	----	---

AMAX: ACK TC

AMAX: ENQ TC

LIS: STX | D | 11111111 | PTT | ETX Checksum TC

	20	8
--	----	---

AMAX: ACK TC

AMAX: ENQ TC

LIS: STX I 11111112
20

NEUMANN
40

LOCATION
20

Comment
40 ETX Checksum TC

AMAX: ACK TC

AMAX: ENQ TC

LIS: STX D 11111112 PT ETX Checksum TC
20 8

AMAX: ACK TC

AMAX: ENQ TC

LIS: STX D 11111112 FIB ETX Checksum TC
20 8

AMAX: ACK TC

AMAX: ENQ TC

LIS: EOT TC

14.2.5 Result Transmission (continuously)

AMAX: DLE TC

LIS: ACK TC

AMAX:	STX	R	AMAX1	11111111	PT	
			5	20	8	
			12.3	95.4	1.03	
			5	5	5	20
						ETX Checksum TC

LIS: ACK TC

AMAX:	STX	R	AMAX1	11111112	PT	
			5	20	8	
			14.0	74.4	1.10	
			5	5	5	20
						ETX Checksum TC

LIS: ACK TC

(up to 40 Results)

AMAX: EOT TC

14.2.6 Export (upload from AMAX to LIS)

AMAX: DLE TC

LIS: ACK TC

AMAX: STX H AMAX1 TT/MM/JJJJ ETX Checksum TC

	5	10
--	---	----

LIS: ACK TC

AMAX: STX I 11111111

20

INSTANCE NAME
40

LOCATION
20

Comment
40

 ETX Checksum TC

LIS: ACK TC

AMAX: STX D 11111111 PT

20	8
----	---

12.3	95.4	1.03		ETX Checksum TC
5	5	5	20	

LIS: ACK TC

AMAX: STX D 11111111 PTT

20	8
----	---

32.4				ETX Checksum TC
5	5	5	20	

LIS: ACK TC

AMAX:

STX

I	11111112
	20

NEUMANN
40

LOCATION
20

Comment
40

ETX Checksum TC

LIS:

ACK TC

AMAX:

STX

D	11111112	PT
	20	8

14.0	74.4	1.10			ETX Checksum TC
5	5	5	20		

LIS:

ACK TC

AMAX:

EOT TC

14.2.7 ID Query (real-time)

AMAX: DLE TC

LIS: ACK TC

AMAX: STX | Q | AMAX1 | 11111111 | ETX Checksum TC

	5	20
--	---	----

LIS: ACK TC

AMAX: EOT TC

LIS answers with corresponding sample data:

AMAX: ENQ TC

LIS: STX | H | AMAX1 | TT/MM/JJJJ | ETX Checksum TC

	5	10
--	---	----

AMAX: ACK TC

AMAX: ENQ TC

LIS: STX | I | 11111111 |

	20
--	----

	INSTANCE NAME
	40

	LOCATION
	20

	Comment
	40

 ETX Checksum TC

AMAX: ACK TC

AMAX: ENQ TC

LIS: STX | D | 11111111 | PT | ETX Checksum TC

	20	8
--	----	---

AMAX: ACK TC
 AMAX: ENQ TC

LIS:

STX

D

11111111

PTT

ETX Checksum TC

20

8

AMAX:

ACK TC

AMAX:

ENQ TC

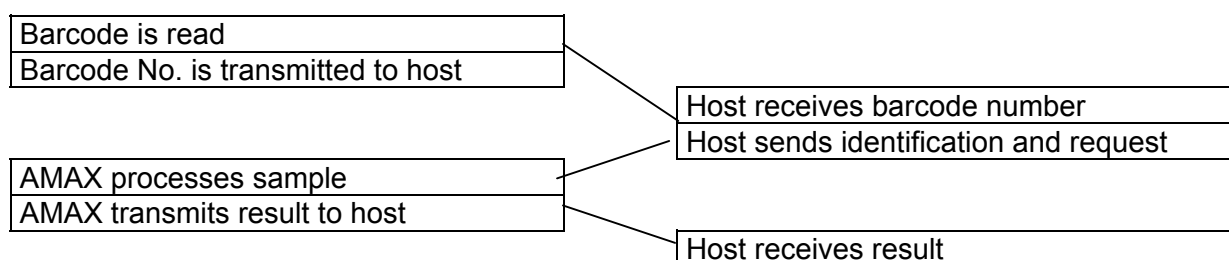
LIS:

EOT TC

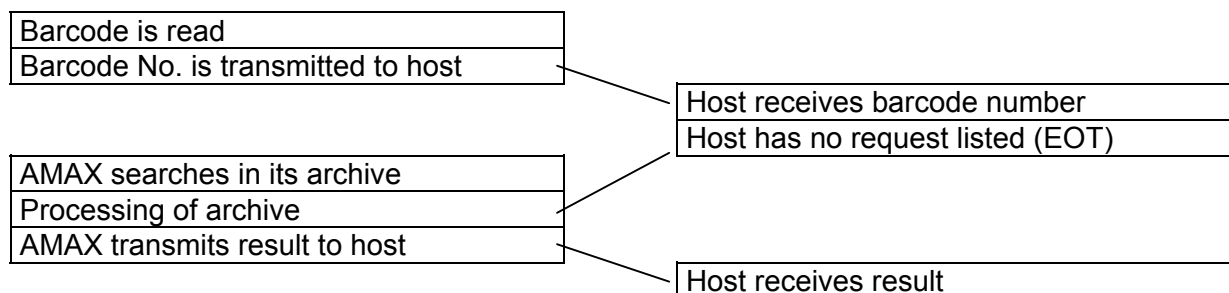
14.3 Host-Communication

14.3.1 Procedure of Processing Real-Time with Barcode

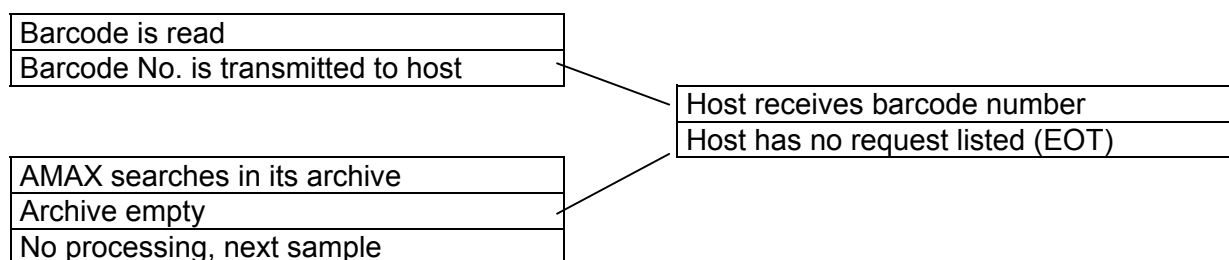
1. Barcode readable and defined in host



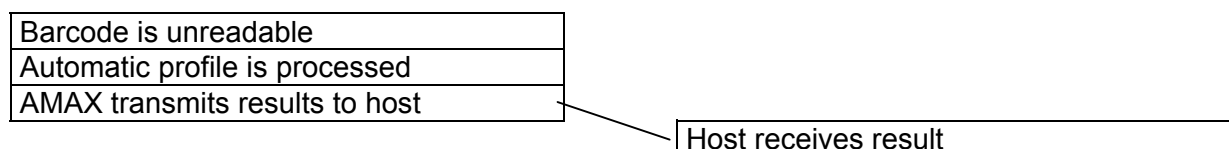
2. Barcode readable, not defined in host, defined in archive



3. Barcode readable, not defined in host, not defined in archive



4. Barcode unreadable, automatic profile defined, NONULBC not defined



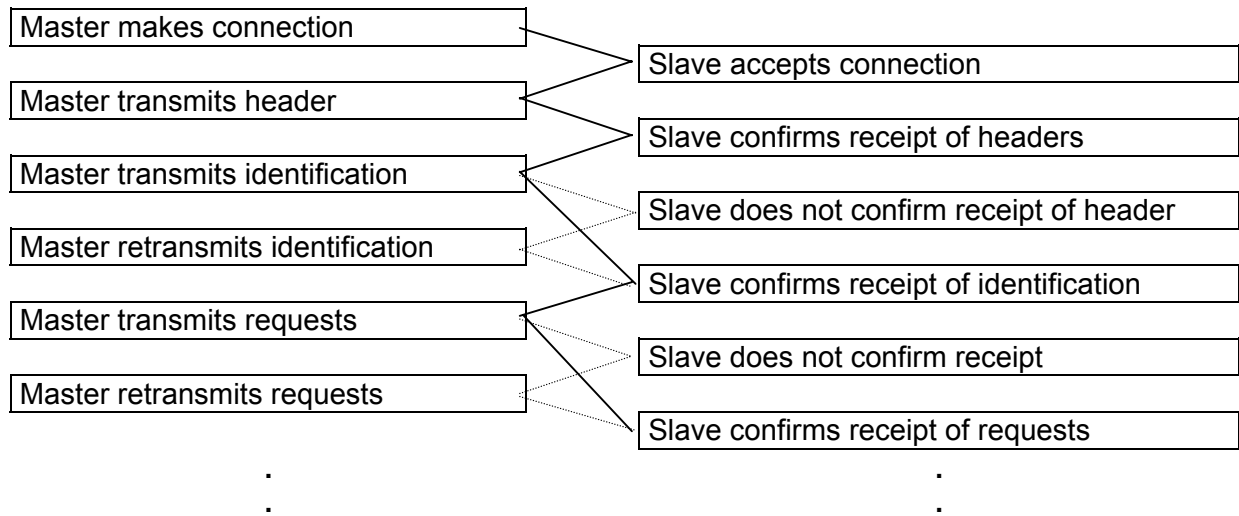
5. Barcode unreadable, NONULBC defined

Barcode is unreadable
Next sample is scanned
At third unreadable barcode - finish

6. Barcode is “Zero”-barcode, NONULBC not defined

Barcode is Zero-Barcode
Next sample is scanned
At third unreadable barcode - finish

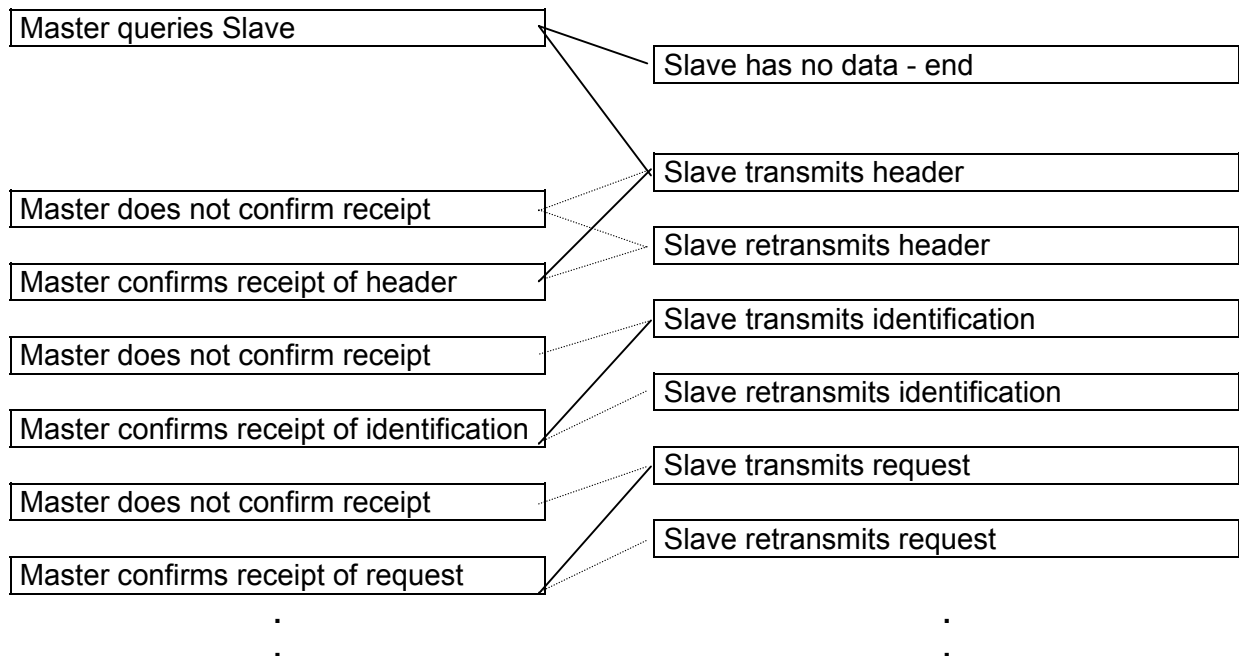
14.3.2 Master to Slave



Until all requests have been transmitted

Master breaks of communication

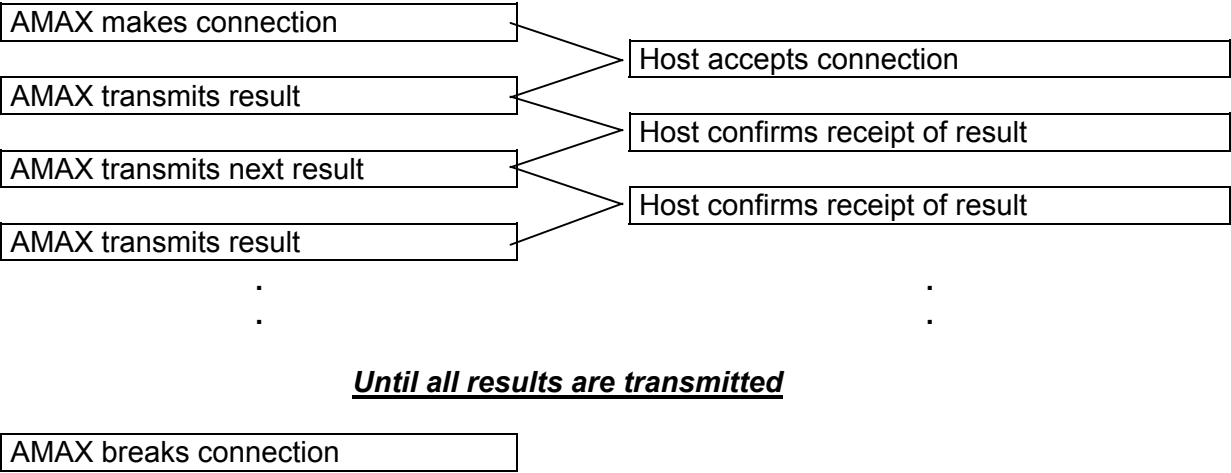
14.3.3 Slave to Master



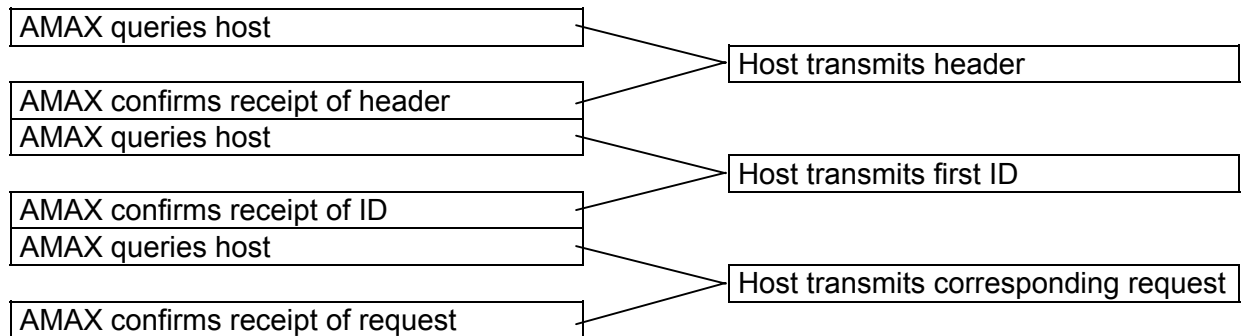
Until all requests have been transmitted

Master breaks of communication

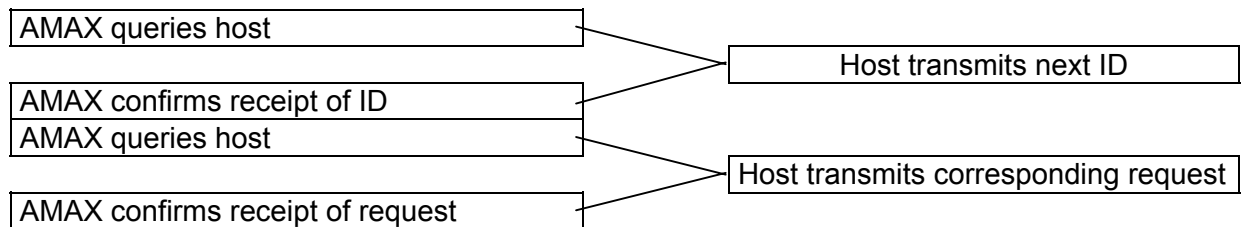
14.3.4 Result Transmission (continuously)



14.3.5 Import of Requests (AMAX = MASTER)



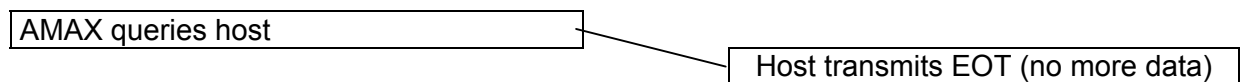
Until all requests for this sample have been transmitted



Until all requests for this sample have been transmitted

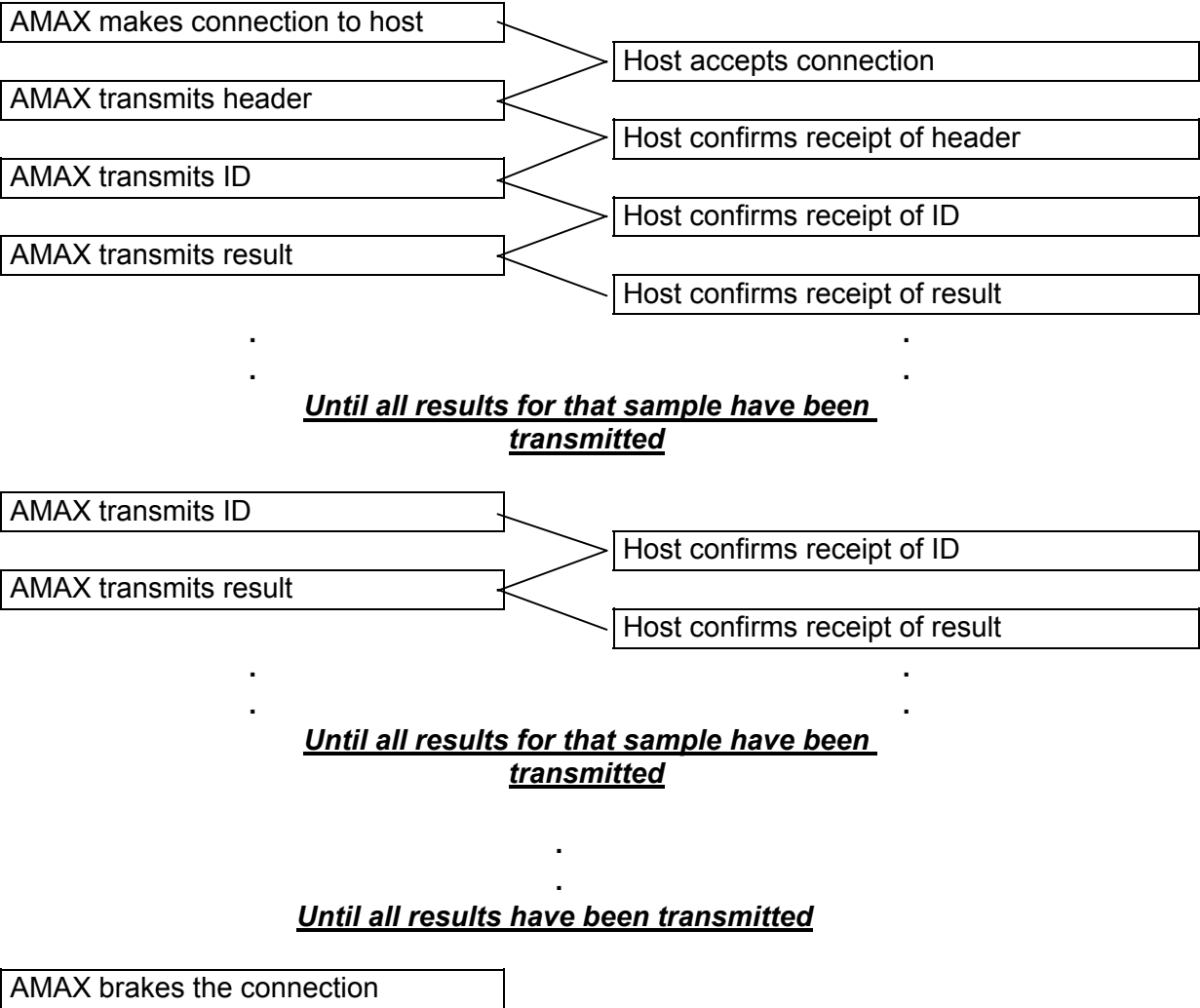
⋮

Until all samples have been transmitted



Data transfer is completed

14.3.6 Export of Results (AMAX = MASTER)



15. DOS Parameters

15.1	AMAX CS-190 DOS Parameters	15 – 1
15.2	Files in AMAX Directory	15 – 3

15.1 AMAX CS-190 DOS Parameters

Tab. 15.1.1 shows the **DOS parameters** which can be used to start the AMAX CS-190. When the user software (main menu) is ended, the text on the screen says: C:\AMAX. Now enter "**AMAX ?**" or "**AMAX HELP**". A list of possible commands is printed on the screen. The commands can be used directly or be included into the file "**AMAX.INI**".

Examples:

1. Direct input:

C:\AMAX\DEMO

2. File AMAX.INI: Open the file with the editor. Enter the desired command and save the file. When the user software (main menu) is started, the change in the AMAX.INI will be executed.

Tab. 15.1.1

? oder HELP	Help text
DEMO	Operating program is entered ignoring the presence of the instrument. The status line will display DEMO in the bottom left corner. The same thing will happen any time the operating program is entered and the instrument is either not present or a signal is not received from the AML-BUS interface board. The instrument is not controlled. If the AML-BUS-board is not detected, the software is started in the DEMO mode automatically.
ITCHK	Incubation time check In CS-190 Status display, incubation times will be displayed in the sample ID area and the test number being processed in the occupied positions of the incubation rail.
AMAX=USEPOOL	All sampling is from Reagent tray position #24
AMAX=TESTREAD	Dilution test Absorbance readings are read before and after addition. Functions only with optical measuring mode and singleton testing.
AMAX=NOREPEAT	Inhibits the auto-repeat function after CV or NC errors when testing in duplicate
AMAX=TEST	As above in AMAX=TESTREAD plus the temperature is recorded in 20 second intervals. Information is dumped into the file: TEMP.DMP
HOST=nn	<nn> defines the transmission retry time of the bi-directional interface in seconds. Without this option, the timeout is 10 seconds.
LPT=HP	Enables a standard HP DeskJet printer driver

DUMP=nn	nn defines a module. All bus communication between the defined module and the PC is dumped to a text file (DUMP.FLE) on the hard drive.
AUTOLAMP	The lamp is not turned on automatically with program initiation. The lamp is turned on only as needed (requested optical tests). The lamp will come on when processing is started on an optical test. After 15 minutes of inactivity, the lamp will turn off. This option can cause considerable wear and a shortening of the lamp life unless optical tests are only run on rare occasions. Optical tests using the One-Step or Two-Step Pipetting Modes, cause the lamp to be turned on at the start of processing. The lamp status will no longer be displayed in red and therefore not initiate error messages.
AMAX=NONULBC	Disables the not readable barcode function using a zero barcode
HOST=DUMP	All LIS communications (in and out) are dumped to a text file (HOSTDUMP.TXT) on the hard drive of the commander PC.
NOBCCHK	Available on versions 3.1.13 or above Samples are rescanned before actual plasma aspiration begins. If on a sample position a different barcode is read as at the initial scanning, that sample will not be processed and in place of a result an error code 6 will be displayed (Error code 6: ID-Error). This function can be disabled using this DOS parameter.
HOST=NORESEND	Available on versions 3.1.13 or above Inhibits the repeated transmission of results after faulty attempts. Ensures that the host is not continuously busy because of host failures and thus stops processing.
NOREFILLTANK	Prevents monitoring of the level of fluids in all fluid reservoirs If refilling is required in any of the fluid reservoirs, a message is displayed requesting that the reservoir be filled.
ARCPRIO	Available on versions 3.1.13 or above When operating in real-time mode, gives the patient archive request data priority over data received from the host.

15.2 Files in AMAX Directory

In table 15.2.1 the files found in directory C:\AMAX and their functions are listed.

Specific files can be accessed and changes made using the DOS Editor.

Tab. 15.2.1

File Name	Contents	Text	Could file be missing
AMAX.CCL	Colour tables To adjust use <ALT+F9> and <ALT+F10>	No	Yes
AMAX.CFG	Configuration of the measuring channels Contains only one number 1= optical only 2= mechanical only 3= mechanical and optical	Yes	Yes
AMAX.EXE	AMAX-Programme	No	No
AMAXHELP.nnn	Help Text Files	No	Yes
BARCODE:INI	Initialisation sequence for integrated barcode scanner; adjust with the Service Software	No	Yes
BCMASK.DAT	Parameters for manipulation of the barcodes Contains two numbers: 1 st number = Number of digits (from the left) to be deleted 2 nd number = Number of digits (from the right) to be deleted	Yes	Yes
CUPCOUNT.DEF	Cuvette counter Contains four numbers	Yes	Yes
DEMI16BI.OVL	Protected-Mode Runtime library	No	No
DRIVE.DAT	Disc drive and pathway for storing the patient archive	Yes	No
DUMP.FLE	Log of bus-communication with a designated module (activate with parameter DUMP=n)	Yes	Yes
EGAVGA.BGI	Graphic Driver	No	No
EXPOT.BUF	Data-buffer Used by HOST.DLL (Bidi-Drive)		
HOST.DLL	Bidi-Host Drive	No	Yes
HOST.PRM	Parameter for the Bidi-Host Drive	No	Yes
HOSTPAT.DAT	Recorded patient data, still to be transferred into the patient archive	No	Yes
IMPORT.BUF	Data buffer used by HOST.DLL (Bidi-Drive)	No	Yes
IOAMAX.DLL	Programme manager	No	No
LOGCMD.DAT	Command list: hit <ALT+F5> to see The file is not readable as clear text.	Yes	Yes

MEASLOCK.DAT	Table of locked off measuring cells The file contains one line of 8 digits. Left to right the digits correspond to the 4 optical and the 4 mechanical measuring channels. One "X" blocks the corresponding channel, every other digit does not.	Yes	Yes
MEASM.DEF	Specially chosen and letter coded measuring modes To set up open menu System/Parameter/Measuring-modes.	No	Yes
OFFSET.DAT	XYZZ-Robot alignment values To alter use the Service Software	No	Yes
ONLINE.PRM	Parameters for the unidirectional interface To alter use menu System/Parameter/On-Line.	No	Yes
OPTION.TAB	Option Set-ups	No	Yes
PASSWD.DAT	Password - contents are coded Use the passepartout (over-ride password) if there is no file.	No	Yes
PHOREF.DEF	Photometer calibration values The first 4 values correspond to measurement with water, the next four values correspond to the dark values. (ADW-Offsets)	Yes	Yes
PHOTO.BIN	Photometer measuring programme	No	No
PHOTOM.VER	Photometer loading programme version	Yes	Yes
PROFIL.DAT	Test profiles Set up using menu System/Profile.	No	Yes
PUMP.DEF	Pump parameters	No	Yes
REAG.DEF	Reagent definitions	No	Yes
REAGL.DEF	Reagent tray configurations	No	Yes
REFERTO.DAT	Report format	No	Yes
REPARTI.DAT	Department/Ward	No	Yes
RTM.EXE	Protected-Mode stub	No	No
STAT.DAT	Quality controls	No	Yes
TCORR.DAT	Time correction factors Two factors (A and B) can be entered for every test to correct the time values (one line/Test). Time value (corr) = Time value (measured) x A+B	Yes	Yes
TEMPO.DAT	Correction values for the temperature displays The file contains 5 values. The correction values (0.1 grade-units) will be added to the measured temperature. The values are listed in following order: Reagent tray, probes, opt. meas. cell, mech. meas. cell, incubation rail.	Yes	Yes

TEMPWIN.DEF	Temperature observation window To alter use menu System/Parameter/Temperatures.	No	Yes
TEST.DAT	Test parameters To alter use menu System /Parameter /Tests.	No	No
TESTG.DEF	Test groups To alter use menu System /Parameter /Test groups.	No	Yes
TSTX.EXE	Programme for adaptation of test parameters from version 2.X to 3.0 Attention: use once only!	No	Yes
TUBE.DEF	Levels To alter use menu System /Parameter /Levels.	No	Yes
VCORR.DAT	Correction factors for TWO-STEP sampling mode First line: "A" or "P"; A = absolute correction P = proportional correction Further lines contain 12 values. Minimum of one space to separate the values. Columns created in this way will be placed according to test-group size e.g. group=4 - the correction factor will be placed in column 4. Second line: Back-lash volume (12 values in microliter) 3rd - 14th lines: when the first line = "P", values are correction factors of the last to the first sampling. (e.g. 1.03 = 103%), when the first line = "A", then the values are backlash volumes of the last to the first samplings.	Yes	Yes

● A M E L U N G AMAX CS-190

Maintenance

Customer:	
Customer no.:	
Instrument no. internal:	
Instrument no. external:	
Last maintenance :	

Please mark:

Working Point:	Activity tested/ checked	Activity (1) replaced (2) cleaned	(3) lubricated (4) adjusted	Spare Part No. Amelung/Sigma
System Fluid Circuits				
Coolant filter (replace)	O	(1) O (2) O (3) O (4) O		241071/W0514
System fluid	O	(1) O (2) O (3) O (4) O		830040/A0589
Air filter (condition)	O	(1) O (2) O (3) O (4) O		120396/S9303
Tubing System				
Check coolant tubing for deposits	O	(1) O (2) O (3) O (4) O		
Check waste water pump tubing for blockages and leaks (Check functioning of the pump)	O	(1) O (2) O (3) O (4) O		241051/W1014
Check waste water tubing (well) for blockages	O	(1) O (2) O (3) O (4) O		
Check tubing set <i>fresh water</i> Test function of the fluid level sensor (BNC-plug)	O	(1) O (2) O (3) O (4) O		Q90006/T3062
Check tubing set <i>waste water</i> Test function of the fluid level sensor (BNC-plug)	O	(1) O (2) O (3) O (4) O		Q90007/T3187
XYZZ-Robot				
Clean and lubricate all axes, shafts, guides and gliding rails	O	(1) O (2) O (3) O (4) O		
Driving belt (tension)				
Toothed belt (X-motor-pinion)	O	(1) O (2) O (3) O (4) O		120448/T2312
Toothed belt (X-drive)	O	(1) O (2) O (3) O (4) O		120449/T2062
Toothed belt (Y-motor-pinion)	O	(1) O (2) O (3) O (4) O		120453/T1062
Toothed belt (Y-drive)	O	(1) O (2) O (3) O (4) O		120451/T1187
Needle (condition, function)	O	(1) O (2) O (3) O (4) O		D10082/A1708
Temperature needle heating (41±1.0°C container)	O	(1) O (2) O (3) O (4) O		
Cuvette Magazine				
Clean and lubricate all axes, shafts, guides and gliding rails	O	(1) O (2) O (3) O (4) O		
Disposal conveyor (function)	O	(1) O (2) O (3) O (4) O		
Cuvette chute mounting lifting solenoids (function)	O	(1) O (2) O (3) O (4) O		

● A M E L U N G AMAX CS-190

Maintenance

Working Point:	Activity tested/ checked	Activity (1) replaced (2) cleaned	(3) lubricated (4) adjusted	Spare Part No. Amelung/Sigma
Reagent-Plasma-Tray				
Toothed belt pinion primary shaft (tension)	O	(1) O (2) O (3) O (4) O		120461/
Toothed belt motor pinion (tension)	O	(1) O (2) O (3) O (4) O		120462/
Cooling (16.5±1.5°C)	O	(1) O (2) O (3) O (4) O		
Photometer				
Measuring channels (dirt)	O	(1) O (2) O (3) O (4) O		
Cuvette holding springs (tension)	O	(1) O (2) O (3) O (4) O		120924/C6716
Electrical adjustments	O	(1) O (2) O (3) O (4) O		
Lamp voltage (lamp condition)	O	(1) O (2) O (3) O (4) O		247410/A3335
Temperature (37.5±0.3°C)	O	(1) O (2) O (3) O (4) O		
Mechanical Measuring Unit				
Cuvette holding springs (tension)	O	(1) O (2) O (3) O (4) O		359412/C6591
Drive belt (tension)	O	(1) O (2) O (3) O (4) O		120440/F7173
Hinge mechanism (Performance check)	O	(1) O (2) O (3) O (4) O		
Temperature (37.5±0.3°C)	O	(1) O (2) O (3) O (4) O		
Dilutor Unit				
Dilutor syringe (integrity)	O	(1) O (2) O (3) O (4) O		290007/A1833
Plunger (teflon)	O	(1) O (2) O (3) O (4) O		350350/S9178
O-ring	O	(1) O (2) O (3) O (4) O		350121/S03015
Toothed belt (condition)	O	(1) O (2) O (3) O (4) O		120505/
Level Sensor/Height Scanner				
Z-axis (function)	O	(1) O (2) O (3) O (4) O		

Test run: Instrument OK.	
Maintenance carried out on	
Next maintenance	
Technician signature	
Customer signature	